Logistics Management Institute

Government-Imposed Barriers to the Use of Commercial Integrated Circuits in Military Systems

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Government-Imposed Barriers to the Use of Commercial Integrated Circuits in Military Systems

Executive Summary

Using more commercial and commercially derived silicon-based integrated circuits in DoD hardware can save the Department money and give it access to better technology. Before the defense industry can use more commercial integrated circuits, however, barriers imposed by the Federal government must be overcome. These barriers fall into two general categories: technical and administrative. Technical barriers restrict what DoD and its contractors buy; administrative barriers influence how, and from whom, they buy.

A commercial integrated circuit is one whose design, manufacturing processes, logistics support, and terms of sale are targeted toward a civilian market. Instead of one single, simple description for commercial integrated circuits, a conglomeration of performance requirements, design approaches, manufacturing processes, distribution channels, and product support exists. Two major initiatives, the military specification and standard reform initiative and the Federal Acquisition Streamlining Act of 1994 (FASA), offer to make it easier for defense contractors to buy commercial products. Nevertheless, in both technology and acquisition practice, major barriers remain.

The most significant technical barrier to the use of commercial integrated circuits is design conservatism due to a lack of data that characterize the commercial devices and the military environments in which those devices would have to perform. Not all commercial integrated circuits will operate reliably under military conditions, but neither are all military applications equally stressing. The challenge in each case is knowing when commercial integrated circuits can be used with confidence. Several DoD research-and-development programs are compiling data on the characteristics of commercial integrated circuits, but these efforts are not cohesively or centrally managed.

We recommend a comprehensive DoD effort to collect data on the ability of commercial integrated circuits to operate in military environments. A Center for Commercial Integrated Circuit Insertion – run by a Service laboratory or nonprofit research institute – should oversee research in this area and should serve as a clearinghouse for dissemination of project results. We also recommend that DoD clarify and expand MIL-STD-883D, *Test Methods and Procedures for Microelectronics*, to define device classes for which defense and commercial applications are similar.

Some military specifications and standards unnecessarily raise technical barriers. MIL-STD-454N, *Standard General Requirements for Electronic Equipment,* and Military Handbook 217F, *Reliability Prediction of Electronic Equipment,* inhibit the use of commercial integrated circuits. The barriers they present should be greatly reduced by the current reform.

Not all military specifications and standards should be abandoned, however. The Qualified Manufacturers List Program and the Standard Microcircuit Drawing Program are based on military standards and specifications that have few direct commercial analogs. The Defense Electronics Supply Center has improved these programs over the past five years in response to industry requests and numerous studies. Notably, the qualified manufacturers list replaces the qualified parts list and establishes process control as DoD's preferred quality assurance technique for integrated circuits. We recommend these programs be retained and further improved. We also recommend that they be contractually optional (neither banned nor mandatory), but that contractors who choose not to use them should be obligated to identify acceptable alternatives.

Producers of commercial integrated circuits that meet military technical requirements might be reluctant to sell those products to defense contractors because of data and reporting requirements that flow down to subcontractors. Examples are the requirements for providing detailed cost data, for cost collection and reporting, for source restrictions, for data rights, or that were implemented for socioeconomic reasons. Many of these remain despite the FASA.

DoD's cost collection and reporting requirements mandate specialized information systems that have neither close counterparts nor business value in a commercial setting. FASA greatly reduces the government's ability to collect cost or pricing data, but other potential barriers, such as audit rights, remain. The contracting community should seek to remove all burdensome conditions on its purchases of commercial items.

FASA also did not relieve requirements for cost and schedule control systems. While these requirements are necessary for effective management of military-unique development projects, they could lead to unintended requests for cost data on commercial components. These requirements effectively flow down to all tiers, affecting suppliers of commercial items whenever the prime contractor buys hardware or design services. Both the government and its prime contractors need to ensure that, for commercial items, access to such information does not extend beyond what is normally available in the commercial marketplace.

Several contract clauses restrict the origin of defense supplies and components. These source restrictions have no counterpart in the commercial world and can cut off DoD from a wide range of suppliers — including overseas plants of U.S. corporations (which is common in the integrated circuit industry). These restrictions are not addressed by FASA. The Buy American Act and the Trade Agreements Act would have to be amended to bring relief.

The retention of private data rights is key to competitiveness for many companies. While FASA makes major strides in preserving commercial firms' interests, government practice continues to differ from the commercial sector. Contractors must specially mark technical data, must maintain records justifying those markings, and must be prepared to deliver to the government technical data for two years after the last item in which those data are used is delivered to the government.

The government uses its status as a buyer to promote socioeconomic goals over and above those affecting general commerce. Specialized socioeconomic requirements impose burdens and potential liabilities not found in commercial business and are therefore a barrier, especially for the integrated circuit industry, where the government is not a major buyer. FASA grants no exemptions from incremental socioeconomic requirements.

To overcome administrative barriers not addressed by FASA, DoD may

- petition the Administrator of the Office of Federal Procurement Policy to get these provisions and clauses added to the list of those not applicable to commercial-item contracts or subcontracts,
- seek special legislative action, or
- obtain waivers, where such authority exists, from the Secretary of Defense, the military service secretaries, or other officials designated by the Secretary of Defense.

Contents

Contents (Continued)

Illustrations

Tables

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Preface

The Department of Defense initiatives for military specifications and standards reform and for acquisition reform are evolving rapidly as we go to press. Some barriers to the military use of commercial integrated circuits that we describe may have been reduced by reforms implemented after this report was written.

CHAPTER 1

Introduction and Summary

PURPOSE

In this study, the Logistics Management Institute identifies government-imposed barriers to the insertion of commercial, silicon-based integrated circuits (ICs) into defense products and recommends changes for reducing those barriers. These barriers, whether in regulation or in practice, cause IC makers to segregate their businesses into defense and commercial divisions and can deter currently commercial-only firms from entering the defense market.

Because of unique technical requirements and buying practices, DoD has fostered an industrial sector that is generally distinct – technically and organizationally – from its commercial counterpart. However, defense outlays have declined each year since FY87 (constant FY87 dollars). Between FY87 and FY93, procurement outlays fell 22 percent. With the Federal budget tightening, DoD will begin fewer new programs for weapon systems, and those systems will be produced in lower quantities than in the past. Existing systems will be upgraded and will remain in use longer than originally intended. In the current fiscal climate, the United States cannot afford a separate industrial infrastructure for defense.

To get the most out of its declining procurement budget, DoD is encouraging integration of commercial and military industry, where defense items are produced with the same facilities as commercial items, and dual-use applications, where the same item can have both commercial and military uses. Dual use also helps DoD avoid development costs. Dual use can apply to a product or process, and the application can flow either way between commercial and military. In this report, we refer to "insertion" as the case in which commercial or commercially derived products are used in military systems.

Encouraging commercial IC insertion is complicated because DoD is not a direct buyer of ICs; most ICs bought by DoD are purchased indirectly when DoD buys components, assemblies, or commercial items that contain ICs. Thus, the barriers to using commercial ICs at the supplier level are due to the effects of government actions that flow down through the tiers. In some cases, the requirements causing the barriers are not imposed by government fiat but are imposed instead by prime contractors on their suppliers. In those cases, relief is at the discretion of prime contractors.

DoD expects to gain three major benefits from commercial IC insertion. The first is access to a larger, more diverse supplier base. The second is lower costs resulting from having a larger base and thus more competition. The last is better

access to new technology, which should also result from having access to a larger supplier base.

DEFINITION OF COMMERCIAL INTEGRATED CIRCUITS

A commercial IC is one whose design, manufacturing processes, logistics support, and terms of sale are targeted toward a civilian market. Instead of one single, simple specification or business practice for commercial ICs, a conglomeration of performance requirements, design approaches, manufacturing processes, distribution channels, and product support exists. Large, high-volume IC users can buy directly from IC manufacturers; low-volume IC users usually must buy from distributors.

The commercial market for ICs is commonly broken into two categories — "consumer grade" and "industrial grade" — on the basis of the harshness of the environment in which the chips must operate. Loosely defined, consumer-grade devices are designed for home and office use, while industrial-grade devices are designed for automotive and factory use. Other major industrial sectors using ICs are commercial telecommunications, avionics, and space. Inserting commercial ICs into defense products requires careful specification of the kind of commercial ICs to be inserted and the channel of sale — including technical documentation, quality assurance, and technical support — to be used for their purchase.

OVERVIEW OF THE INTEGRATED CIRCUIT INDUSTRY

Defense Participation in the Semiconductor Industry

DoD exerts little influence on the IC market. Figure 1-1 shows the U.S. share of the world market for IC shipments and DoD's IC purchases. Since 1982, the U.S. share of the world market has declined from 79 percent to 45 percent. The domestic industry shipments are for Standard Industrial Classification (SIC) 3674, *Semiconductors and Related Devices*, which in addition to integrated circuits includes discrete semiconductor parts (e.g., transistors, diodes, and rectifiers). The DoD amount is an estimate of direct plus indirect defense purchases based on the Defense Economic Impact Modeling System (DEIMS).[1] DEIMS estimates that direct defense purchases are only 5 to 6 percent of total defense demand.

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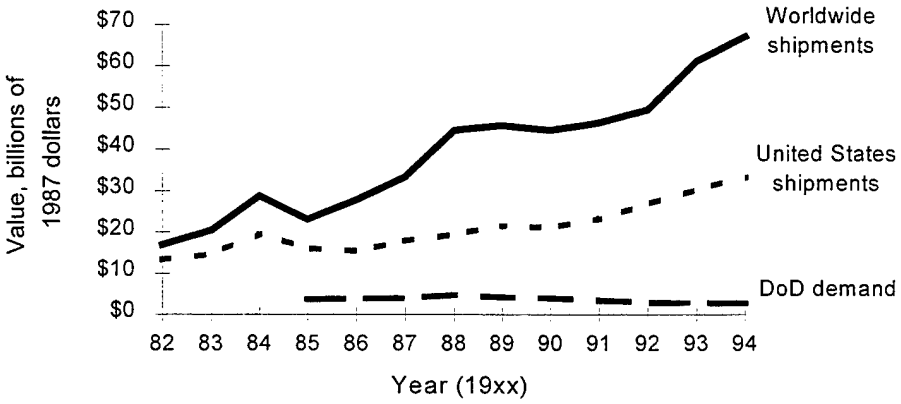
[1]DEIMS is a DoD model that translates the Future Years Defense Budget into DoD demand on industries in the U.S. economy. It uses an input-output analysis to estimate both the direct and indirect defense demand on the economy. The most recent DEIMS data are based on the FY91 budget and probably underestimate the downward trend in defense procurement.



Sources: U.S. Industrial Outlook (U.S. shipments and 1993 – 1994 world shipments), Semiconductor Industry Association (1982 – 1992 world shipments), and DEIMS (DoD demand).

Figure 1-1.
Semiconductor Shipments and DoD Demand

The DoD share of the U.S. IC market declined from 23 percent in 1985 to 8 percent in 1994,[2] and defense budgets are likely to continue shrinking. ICs will continue to be a small share of an individual weapon system's cost. For example, at one company, although electronics account for a substantial portion of system costs, ICs themselves on average account for only 1 to 3 percent of the total cost.[1]

Product Technology Trends

IC technology advances rapidly, with higher performance continually becoming available at a decreasing cost. DoD research no longer drives technical advancement in the IC industry. Exceptions are niche areas such as ICs for night-vision equipment, which require exotic materials rather than common silicon.

We illustrate technology trends with selected IC products. Table 1-1 shows the change in product shipments, in terms of dollar value, for the five-year period from 1987 to 1992. Total industry shipments increased 8 percent, but in

[2]The DEIMS industry classification "Semiconductors" is equivalent to SIC 3674, *Semiconductors and Related Devices.*

each case, shipments of the less complex product declined (or increased only slightly) and shipments of the most complex product increased. For example, shipments of simple microprocessors (4 bit and 8 bit) declined 56 percent, while shipments of more complex microprocessors (16-bit and 32-bit) increased 208 percent. The electrically erasable, programmable, read-only memory (EEPROM) chips are the newest technology represented. Shipments of the larger-memory chips have increased 570 percent during the five years.

Table 1-1.
Shipments of Selected Products in the Semiconductor Industry

Product	Shipment value (millions of 1987 dollars)		Percentage change
	1987	1992	
Microprocessors			
4 bit + 8 bit	365.4	159.1	–56.4
16-bit + 32-bit	913.4	2,813.2	208.0
DRAMs			
< 80,000 bits	89.4	33.4	–62.6
> 80,000 bits	863.6	1,279.9	48.2
SRAMs			
< 80,000 bits	356.8	368.9	3.4
> 80,000 bits	40.2	341.9	750.6
EPROMs			
< 80,000 bits	239.9	158.8	–33.8
> 80,000 bits	344.9	542.4	57.3
EEPROMs			
< 80,000 bits	177.6	134.8	–24.1
> 80,000 bits	24.4	163.4	569.5
All Semiconductors	19,794.9	21,350.5	7.9

Sources: Department of Commerce, Bureau of the Census, *Industry Series: Electronic Components*; and Department of Commerce, Bureau of the Census, *Semiconductors, Printed Circuit Boards, and Other Electronic Components* .

Note: DRAM = dynamic, random-access memory; SRAM = static, random-access memory; and EPROM = erasable, programmable, read-only memory.

Defense demand for ICs differs significantly from commercial demand in the volumes required and in the variety of parts. Commercial buyers tend to purchase high volumes of a small number of chip device types, while DoD buys a low volume of thousands of different device types. The Defense Logistics Agency's Defense Electronic Supply Center (DESC) surveyed companies in the commercial automotive, telecommunications, avionics, and space industries about how they purchase ICs. The commercial industries generally use fewer than 300 different device types, whereas DoD uses more than 12,000. Part of the reason for the large number of parts is that DoD purchases items from a significant number of manufacturing industries.

Table 1-2 shows how the prices of the selected products have changed over the period 1987 to 1992. Prices declined for most products as the quantities shipped increased, and also more capability is now available at lower cost. For SRAMs and EPROMs, the average price per unit for the higher capability is lower today than the price of less capability was five years ago. In 1987, EEPROMs with large memories were a leading-edge technology; the quantity shipped was low and the price was very high. By 1992, the quantity shipped increased over 5 times and the price declined by 94 percent.

Table 1-2.
Unit Prices of Selected Semiconductor Products

Product	Price per unit (1987 dollars)		Percentage change
	1987	1992	
Microprocessors			
4-bit + 8-bit	3.46	2.60	–24.8
16-bit + 32-bit	33.83	4.34	–87.2
DRAMs			
< 80,000 bits	2.94	4.40	49.5
> 80,000 bits	6.80	6.63	–2.5
SRAMs			
< 80,000 bits	4.19	4.07	–2.8
> 80,000 bits	4.96	3.30	–33.4
EPROMs			
< 80,000 bits	4.47	4.10	–8.1
> 80,000 bits	5.05	1.46	–71.1
EEPROMs			
< 80,000 bits	5.88	0.93	–84.2
> 80,000 bits	122.00	7.26	–94.0

Sources: Department of Commerce, Bureau of the Census, Industry Series: Electronic Components; and Department of Commerce, Bureau of the Census, Semiconductors, Printed Circuit Boards, and Other Electronic Components.

These trends in the IC industry influence the price DoD pays for ICs used in weapon systems. The commercial industry is characterized by rapid advances in technology; IC product development cycles are 18 to 36 months. Prices are driven down as volumes increase. DoD tends to have long development cycles (10 to 20 years) for major systems, and therefore the design often incorporates outdated IC technology that DoD must support for the many years (often 20 or more) that its systems are operational. Thus, DoD cannot take advantage of newer technology at lower prices and, in some cases, may be paying more for the old technology than it would for newer, more capable technology.[3]

[3]DESC reports that it still buys substantial quantities of the Intel 8088 chip.

MAJOR INITIATIVES AIMED AT REDUCING GOVERNMENT BARRIERS

Two current initiatives will reduce government barriers to inserting commercial ICs into defense systems. The first initiative is military specification (MILSPEC) reform. MILSPEC reform encourages the use of performance-based product specifications and nongovernment standards in lieu of prescriptive military documents. The second initiative is the Federal Acquisition Streamlining Act of 1994 (FASA, Public Law 103-355), aimed at changing requirements, many imposed by statute, for how DoD does business with its suppliers. These initiatives do not completely eliminate government barriers, however, and the bulk of our research has consisted of analyzing these initiatives' effect on IC insertion and determining what barriers will remain.

MILSPEC Reform

MILSPECs document requirements for the development of military hardware and software and for the management of military acquisition programs. While the term MILSPEC is, strictly speaking, an abbreviation for "military specification," DoD commonly uses this term more broadly, as we do here, to include

- military standards, which establish uniform criteria, methods, processes, and practices for developing military-unique applications;
- military handbooks;
- military bulletins;
- DoD standards;
- NATO standards; and
- any other document listed in the DoD Index of Standards and Specifications (DoDISS) and maintained by DoD or other military agency.

Approximately 40,000 MILSPECs provide

- procedures for consistent system development and engineering, e.g., for design reviews and configuration control,
- product specifications,
- test and calibration methods, and
- other technical references.

On 29 June 1994, Secretary of Defense William Perry issued a memorandum, *Specifications and Standards – A New Way of Doing Business.*[2] This memorandum ordered the following immediate changes:

- MILSPECs are to be used as a last resort, following performance specifications and nongovernment specifications, and only with a waiver;
- MILSPECs listed in DoD Instruction 5000.2, *Defense Acquisition Management Policies and Procedures*, are for guidance only; and
- MILSPECs in production contracts are mandatory only through the first reference tier.

The memorandum also ordered the following transitional changes to be phased in:

- "Management and manufacturing" MILSPECs are to be canceled, starting with the "top 10" (which include MILSPECs for system engineering, configuration management, and parts control);[3]
- The government will retain configuration control of only functional and performance requirements;
- Obsolete MILSPECs are to be purged from DoDISS;
- Nongovernment standards and specifications are to added to DoDISS; and
- Military-unique quality assurance techniques are to be replaced with "process control."

For more detailed information on the ordered MILSPEC changes, the memorandum refers to two DoD reports, *Report of the Industry Review Panel on Specifications and Standards* and *Report of the Process Action Team on Military Specifications and Standards: Blueprint for Change.*[3,4]

Federal Acquisition Streamlining Act

The second major initiative, FASA, will make significant changes in procurement regulation. FASA makes a wide range of changes in acquisition policy to reduce oversight and simplify contracting procedures and thus makes government contracting more similar to commercial contracting. Major changes in procurement law include the following:

- The definition of what qualifies as a commercial product is expanded.
- Purchases of commercial items are exempted from more than 30 statutes unique to the government.

- Contracts for commercial items are exempted from the requirement to provide cost and pricing data.
- The threshold under the Truth in Negotiations Act is raised to $500,000.
- The simplified acquisition threshold is raised to $50,000 and will go up to $100,000 when certain conditions are met. Purchases made under that threshold are exempted from 15 statutes.
- More extensive debriefings are required upon award of contract to reduce the number of protests.

KEY FINDINGS AND RECOMMENDATIONS

We analyzed barriers to the insertion of commercial ICs by examining technical and administrative issues. The MILSPEC reform initiative is a major factor in the former, and FASA is the main element of the latter. We began by reviewing the numerous studies that have examined these issues; Appendix A contains a synopsis of their recommendations.

Technical Barriers

The most significant technical barrier to the use of commercial ICs is design conservatism by government engineers and defense contractors. Other technical barriers are imposed by the use of unnecessary MILSPECs. Not all MILSPECs present barriers, however, and some good ones are threatened by the current reform initiative.

Design conservatism reflects a lack of data characterizing the commercial devices and the military environments in which those devices would have to perform. To reduce this barrier, we recommend that DoD clarify and expand MIL-STD-883D, *Test Methods and Procedures for Microelectronics*, to include categories of environmental requirements (generally called "device classes") for which defense and commercial applications are similar. Where commercial analogs exist, that standard should refer to them. We also recommend a comprehensive DoD effort to collect data on the commercial ICs' ability to operate in military environments, including environments for which the manufacturers have qualified the devices but have never published the fact. While several DoD programs are compiling data on the characteristics of commercial ICs, these efforts are not being cohesively or centrally managed. A Center for Commercial IC Insertion should oversee research in this area and should serve as a clearinghouse for dissemination of project results.

The use of unnecessary MILSPECs imposes other technical barriers. Eliminating some MILSPECs from contractual mandate will facilitate inserting commercial ICs into defense items. MIL-STD-454N, *Standard General Requirements for Electronic Equipment*, and MIL-HDBK 217F, *Reliability Prediction of Electronic*

Equipment, inhibit commercial IC use; their use will be justifiably reduced by the MILSPEC reform initiative.

We conclude that MILSPEC reform, while well defined and well intentioned, is sometimes implemented such that MILSPECs are being banned simply because they are MILSPECs, without regard to their purpose, value, or the existence of commercial analogs.[4] We feel that such implementation is inconsistent with both the letter and intent of Secretary Perry's memorandum. In Appendix B, we present an analysis of MILSPEC reform and discuss how it might be improved. In industries where no standards exist, the MILSPECs represent a body of knowledge that is not available anywhere else. To an extent, this is the case in the IC industry.

Two programs related to ICs, the Qualified Manufacturers List (QML) Program and the Standard Microcircuit Drawing Program, are based on MILSPECs that have few direct commercial analogs. The former ensures quality of the ICs DoD buys; the latter helps lower inventories of defense spare parts. Both quality and parts control are practiced widely commercially, but largely on a company-by-company basis. Appendix C discusses how two commercial industries that use ICs in harsh environments manage IC procurement and quality assurance.

The QML Program, which replaces the Qualified Parts List Program, permits foreign sourcing, elimination of unneeded tests, and new packaging technologies and reduces the contractor's reporting burden. The QML specification has recently been revised and approved as the first "military performance" specification. Previously published cost estimates of the benefits of using commercial ICs must be tempered by the fact that their military basis, the qualified parts list approach, is no longer operational practice.

We recommend these programs be retained and improved. We also recommend that they be contractually optional (neither banned nor mandatory) but that contractors who choose not to use them be obligated to identify acceptable alternatives.

Administrative Barriers

Lower-tier producers of commercial ICs that meet military technical requirements might be reluctant to sell those products to defense contractors because of data collection and reporting that are required by the defense acquisition process and that flow down to subcontracts. The primary acquisition barriers are requirements for providing pricing data, for collecting and reporting

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[4]A product liability issue also is associated with MILSPEC reform. Heretofore, the government has assumed liability for defense products developed under MILSPECs. Concurrent with the elimination of MILSPECs from defense contracts is a transfer of product liability to the contractor. Commercial firms may not be eager to assume that liability and may demand compensation for the additional risk (and corresponding insurance) they now must carry.

cost, for data rights, that restrict sources, and that deal with socioeconomic issues. These requirements are imposed by contract clauses. An analysis of each relevant clause is presented in Appendix D.

FASA promotes the purchase of commercial items by the government. Its effectiveness in reducing barriers to the use of commercial ICs, however, is generally limited.[5] A host of unique laws and regulations that remain unaddressed by FASA can have a chilling effect on the desire of commercial firms to become involved in prime contracts or subcontracts with the government.

DoD's cost collection and reporting requirements mandate specialized information systems that have neither close counterparts nor business value in a commercial setting. FASA greatly reduces the government's ability to collect cost or pricing data, but the government continues to impose burdensome conditions and audit rights on its purchases of commercial items. Also not relieved by FASA are reporting requirements for a special type of cost and progress reporting, known as cost/schedule control systems criteria.

Several clauses in government contracts serve to restrict the origin of supplies and components either to domestic or to certain specific treaty-determined country sources. These source restrictions have no counterpart in the commercial world and can cut off DoD from a wide range of suppliers, including overseas plants of U.S. corporations (which are common in the IC industry). FASA does not address either the Buy American Act or the Trade Agreements Act, and so the barriers posed by these laws are still in place.

The retention of private data rights is key to competitiveness for many companies. While the government now presumes that, for a commercial item, the item is developed at private expense and acquires only those technical data customarily provided to the public, some data rights barriers remain. Contractors must specially mark technical data, must maintain records justifying those markings, and must be prepared to deliver to the government technical data for two years after the last item in which those data are used is delivered to the government.

The government often seeks to use its status as a major buyer to promote socioeconomic goals over and above those affecting general commerce. Specialized socioeconomic requirements impose burdens and potential liabilities not found in commercial business and are therefore a barrier to increasing the involvement of commercial firms in the military. In the case of ICs, the government is not a major factor in the market and anything about the terms and conditions of its contracts that is different than normal commercial customers only encourages segregation of commercial from military business. FASA does not grant exemptions from incremental socioeconomic requirements, although the Department of Labor may waive them at the buying agency's request.

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[5]A follow-on to FASA has been introduced in Congress (H.R. 1038). Remaining barriers may be addressed as riders to this bill.

Our interpretations of FASA reflect its status as of July 1995. Various parts of the proposed implementing regulations are subject to public comment. The public's comments may have an impact on the barriers that remain. We recommend keeping close watch on the final regulations to determine the barriers that remain.

To overcome administrative barriers not addressed by FASA, DoD may

- petition the Administrator of the Office of Federal Procurement Policy to get these provisions and clauses added to the list of those not applicable to commercial-item contracts or subcontracts,
- seek special legislative action, or
- obtain waivers, where such authority exists, from the Secretary of Defense, the military service secretaries, or other officials designated by the Secretary of Defense.

REPORT ORGANIZATION

In the remainder of this report, we discuss our findings and recommendations in detail. In Chapter 2 we analyze the technical barriers to commercial IC insertion and the effect of MILSPEC reform. In Chapter 3 we examine the administrative barriers and the impact of FASA. The appendices contain a summary of recommendations from previous reports (Appendix A), an analysis of MILSPEC reform (Appendix B), two case studies of commercial IC procurement and quality management (Appendix C), and a detailed listing of contract clauses raising barriers to commercial IC use in DoD (Appendix D).

CHAPTER 2

Technical Barriers

Before the defense industry can use more commercial ICs, barriers imposed by the government must be overcome. These barriers fall into two general categories: technical and administrative. Technical barriers restrict what DoD and its contractors buy; administrative barriers influence how, and from whom, they buy. A series of reports, beginning with Secretary Perry's 1986 Defense Science Board study, has defined these kinds of barriers and recommended solutions (see Appendix A). The government has made progress in overcoming the barriers, most notably in the Qualified Manufacturers List (QML) Program, and much promising activity is underway in acquisition reform and in MILSPEC reform. Nevertheless, major barriers remain.

The most significant technical barrier to the use of commercial ICs is design conservatism by some government engineers and defense contractors. Other technical barriers are imposed by the use of unnecessary MILSPECs. Not all MILSPECs present barriers, however, and some essential ones are threatened by the current reform initiative.

DESIGN CONSERVATISM

Conservatism in setting technical requirements and selecting part designs limits the use of commercial ICs in military systems. This conservatism on the part of government engineers and defense contractors is due to a lack of data characterizing the commercial devices and the military environments in which those devices would have to perform. Design conservatism is common in hardware engineering, especially where the cost of failure is high. It represents not a reluctance to adopt a new technology, but rather a reaction to uncertainty regarding a new technology's true performance and reliability.

While not all commercial ICs will operate reliably until military conditions, neither are all military applications equally stressing. Some military applications may be benign enough that consumer-grade or industrial-grade devices – as specified for their commercial market – will suffice (but one must also consider that much military equipment must be operated in all regions of the earth and must survive transport). Some commercial devices, although optimized for their target market, will perform reliably in harsher conditions.

The Need for Environmental Data

Environmental data describe the handling and operating conditions a product must survive. Common environmental variables for ICs include

- the range of temperature in which the device must perform,
- the thermal shock to which the device will be exposed,
- the mechanical shock and vibration the device must withstand,
- the amount of moisture to which the device will be exposed, and
- the kind and amount of atmospheric pollutants to which the device will be exposed.

Environmental data can be divided into two categories: requirements and specifications. Environmental *requirements* outline the desired characteristics for meeting a particular application; environmental *specifications* describe a particular device's performance limits. Neither requirements nor specifications are necessarily fixed. For a given application, chip-level requirements can sometimes be relaxed (for a price) by making design changes at higher levels of integration (e.g., adding heat sinks or cooling). Similarly, for a given IC design or product, a given percentage of chips may survive outside of certain specification limits. Better environmental requirements and specifications data would help military hardware designers determine which commercial ICs could be used in which military applications and would increase government confidence in the commercial devices' ability to perform reliably.

Requirements Data

Those who write military IC performance requirements need better data characterizing the environments in which ICs will perform and need to make better use of data characterizing commercial environments. While DoD now permits ICs to be matched to their application, practice has been, and mostly continues to be, that a "military" IC must meet one of two operating environments: space or nonspace.[1] While MILSPECs defining system operating environments exist, the space and nonspace environments for ICs are implicitly defined by the tests that military ICs are required to pass.[2] Those tests are described in MIL-STD-883D, *Test Methods and Procedures for Microelectronics.*

The military nonspace environment is defined so broadly that it includes several commercial environments. Military equipment designed to the nonspace

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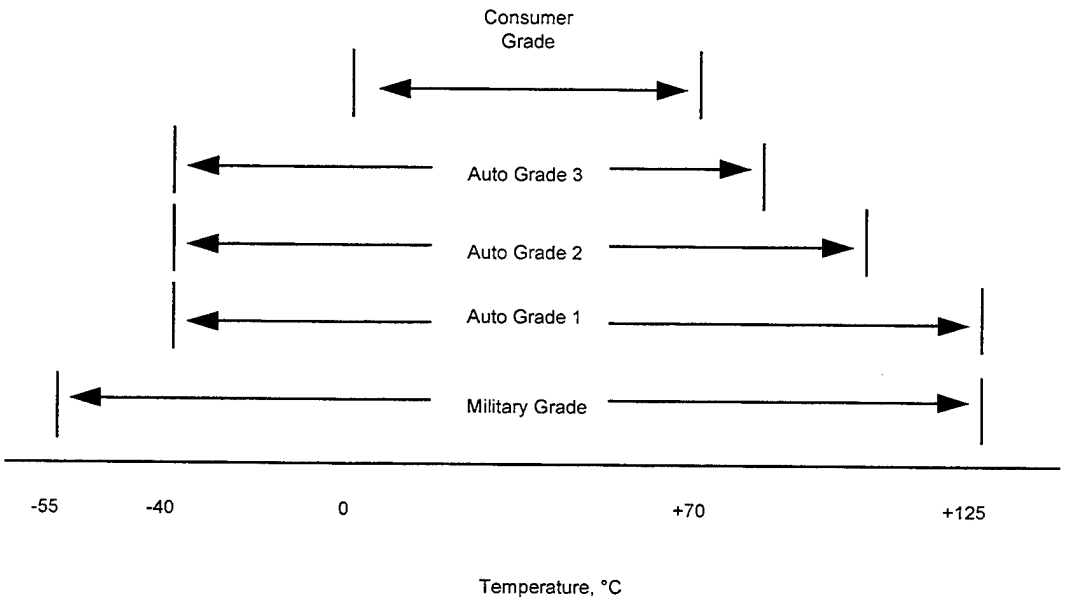
[1]We do not consider DoD requirements for radiation hardness in this report.

[2]See military specifications MIL-E-4158, *General Requirements for Electronic Equipment, Ground,* and MIL-E-5400, *General Specification for Electronic Equipment, Airborne,* for system environmental descriptions.

level, but used in a commercial-like environment, even in wartime, is therefore over-designed. For example, Figure 2-1 compares the military temperature requirement to several commercial requirements. The ambient temperature in which all military ICs historically have been required to survive is -55°C to +125°C.[3] The commercial automotive industry, in contrast, defines three levels of temperature requirements, the most stringent of which is close to the military requirement. The consumer electronics industry uses one temperature range, which is the least robust.



Sources: MIL-I-38535B, *Integrated Circuits (Microcircuits) Manufacturing, General Specification for*; and Chrysler Delco Ford Automotive Electronics Council (CDF AEC), CDF-AEC-Q100, *Stress Test Qualification for Automotive-Grade Integrated Circuits.*

Figure 2-1.
Temperature Requirements for Various Integrated Circuits Grades

DoD should expand its definition of operating environments beyond space and nonspace. In particular, the nonspace environment should be divided into categories that include commercial grades of ICs, such as automotive and consumer. MIL-HDBK-179 (ER), *Microcircuit Application Handbook,* lays the groundwork for these data by identifying six types of military operating conditions, shown in Table 2-1. MIL-STD-883D should be modified to define environmental grades and tests (where possible, by reference to commercial standards) corresponding to the operating conditions defined in MIL-HDBK-179 (ER).

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[3]This specification, from MIL-M-38510J, *Microcircuits, General Specification for,* has been relaxed by successor documents and is discussed later in this chapter.

Table 2-1.
Military Operating Conditions

Category	Typical Application	Temperature (°C)
Protected	Office	0 to +70
Normal 1	Ground radar	–40 to +85
Normal 2	Aircraft cockpit	–55 to +125
Harsh	Uninhabited aircraft area	–55 to +125
Hostile	Tactical missile	–55 to +125
Space	Strategic missile	–55 to +125

Source: MIL-HDBK-179 (ER), Microcircuit Application Handbook, p. 19.

A similar table was generated by an industry group sponsored by DoD. That group's categories appear in Table 2-2. The kind of data we are recommending that DoD incorporate into MIL-STD-883D would expand on this information. The information should identify the relevant parameters – such as temperature, humidity, and vibration – encountered in each environment and the grade of commercial IC that generally performs well under those characteristics.

Table 2-2.
Potential for Commercial Integrated Circuits Use in Various Military Operating Environments

Operating environment	Potential for commercial ICs
Protected	Yes
Normal, readily repairable	Yes
Normal, inhabited	Yes
Uninhabited	Uncertain
Hostile	No
Space	No

Source: The Multi-Use Manufacturing Work Panel of the Industry Task Force for Affordability and The Institute for Defense Analyses, *Accelerating the Use of Commercial Integrated Circuits in Military Systems*,Interim Report, September 1994, p. 10.

SPECIFICATION DATA

DoD has learned through experience how traditional military ICs perform over time in harsh environments. Neither DoD nor commercial industries, however, have much data on how commercial ICs might perform in those environments. Military electronic-system designers need better data characterizing the ability of commercial ICs to operate outside their catalog-published design

specifications. Those published figures often represent the parameter values (reflecting a target market, such as home electronics) for which the manufacturer's design and production process have been optimized. The published specification, however, does not necessarily represent the ultimate capability of the product; for example, an IC manufacturer may qualify a consumer-grade device for a commercial automotive application but may not publish the qualification data in its catalogs.

Where the IC manufacturer measures the same parameters (e.g., mechanical shock) that interest the military, the issue becomes how to encourage commercial IC suppliers to share their qualification data with military IC users. Where the commercial parameter list is incomplete, however, additional product qualification tests should be performed. Using the commercial device without such qualification data could be dangerous in life-dependent applications. For example, as Dr. Noel Donlin notes, "Using the IC beyond the supplier's design rating is a violation of circuit design rules that, with time, may impact missile reliability and present potential hazards. . . ."[5]

Some DoD applications have requirements that are frequently not addressed by commercial specifications. DoD will need assurance that the reliability of equipment with long service lives — 10 to 20 years — does not degrade past the typical commercially observed period of 3 to 5 years, the normal life of commercial products. Also, the military's pattern of use may be different from that of commercial markets. Unlike automobiles or commercial aircraft, some defense systems are used only intermittently. The extreme case is a "wooden round" that is expected to perform on the first attempt after a long period of maintenance-free storage. However, as Dr. Donlin points out, degradation of the life span of the epoxy mold compound used with plastic-encapsulated microcircuits (PEMs) is a prime consideration when the PEMs are placed in uncontrolled environments, with a long dormant storage period, and in the absence of pertinent test data for analyzing risk.[5]

Plastic-Encapsulated Microcircuits

The slow acceptance of commercial PEMs in the military is an example of design conservatism caused by a lack of data on matching commercial designs to military applications. Also, the reliability of early plastic packaging was questionable: "The nearly exclusive use of hermetically sealed microcircuits in military, aerospace, and other high-reliability, high-criticality applications is a direct result of the problems associated with early plastic packaging."[6] Plastic packaging is much improved, however, and may be suitable for military applications beyond what was previously thought possible.

A common, but inaccurate, perception is that the military neither permits nor uses PEMs. While this perception was accurate in the past, it no longer is. MILSPECs now permit the use of PEMs.[7] PEMs have been employed in several military products, including Mobile Subscriber Equipment, the Precision Lightweight Global Positioning System Receiver, Single Channel Ground and

Air Radio System (SINCGARS), the AN/FPS 124 radar, the AN/ARC 164 airborne radio, and sonobuoys.[8] Still, the overall military use of PEMs is limited, and some experts argue that unnecessarily restrictive performance requirements implicitly limit the use of PEMs.

DoD needs a comprehensive, unbiased R&D program to evaluate PEMs – considering the variety of technologies and vendors in the market – and to match them to various military operating environments. Examples abound supporting both the case that PEMs can be used widely and the case that their use should be limited. The U.S. Army Missile Command is hesitant to use PEMs in tactical missiles because of the potential for moisture to penetrate PEMs while they lie in unpowered storage. Although, as Dr. Donlin notes, PEMs "perform as reliably as hermetic parts for many military applications . . . the advantages of cost, availability, size, and weight do not fit all system design and reliability cases."[5] Although several small R&D programs are tackling portions of the problem, no comprehensive effort exists.

Projects Characterizing Commercial Integrated Circuits and Their Military Applications

Several DoD studies have examined the ability of commercial ICs to perform outside their designed operating environments. In one study, five 32-bit microprocessors were subjected to the electrical characterization, mechanical, screening, and quality requirements of MIL-STD-883D. The study concluded that, while none of the evaluated devices operated completely across the entire spectrum of conditions, they could operate over the full military-required temperature range of -55°C to +125°C when a few parameters were relaxed.[9]

DoD is currently conducting several R&D projects to better characterize commercial ICs and to match them to military applications. Table 2-3 lists the projects we were able to identify. Compiling a complete list of these projects is difficult, since each is small and is managed by a Military Department or Defense agency, and since the projects have no central coordinator.

Table 2-3.
DoD R&D Projects Related to Commercial Integrated Circuits

Project	Sponsor
Reliability Without Hermeticity	Air Force Wright Laboratories
Physics of Failure	Army Communications — Electronics Command
Reliability Audit of PEMs in Fielded Nondevelopmental Systems	Army Communications — Electronics Command
Microprocessor Technology Utilization Program	Army Missile Command
Plastic Package Availability Program	Defense Logistics Agency (tri-Service)
Standard Hardware Acquisition and Reliability Program	Naval Surface Warfare Center

We next describe two of these R&D projects. The first focuses on evaluating the functionality of commercial electronics (including ICs) in military systems; the second seeks to characterize and improve the ability of PEMs to withstand military environments. Taken together, these examples illustrate how defense R&D projects could complement each other were they coordinated.

THE MICROPROCESSOR TECHNOLOGY UTILIZATION PROGRAM

The Microprocessor Technology Utilization Program was implemented to examine commercial microprocessor hardware and apply it to developing military systems before the release of any militarized components.[10] The program consists of two engineers at Redstone Arsenal, Huntsville, Alabama, and contract funds of approximately $400,000 per year.

The program principally tests the functionality of commercial ICs in developmental weapons in anticipation that a militarized IC will become available when the system enters production. Despite the name, the program studies the military potential of electronics beyond microprocessors, although microprocessors form the core of the systems studied. Table 2-4 summarizes the accomplishments of the program.

Table 2-4.
Accomplishments of the Microprocessor Technology Utilization Program

Period	Activity
FY86 – FY87	Demonstrated use of commercial PCs for air defense situation monitoring
FY88 – FY89	Demonstrated use of commercial local area network technology to simplify missile electronics interfaces
FY90 – present	Demonstrated use of commercial digital signal processors in a missile computer
FY92	Demonstrated PC-based image compression system for digital map data bases

Source: Microprocessor Technology Utilization Program Advanced Planning Briefing for Industry (undated).

The FY94/FY95 research agenda of the Microprocessor Technology Utilization Program includes designing a remote video compression system with commercial compression processors and PCs. The program has provided support to the following Army programs: The Army Combined Arms Weapon System (TACAWS), Fiber Optic Guided Missile (FOG-M), Unmanned Aerial Vehicle (UAV), and Unmanned Ground Vehicle (UGV).

THE PLASTIC PACKAGE AVAILABILITY PROGRAM

The purpose of the Plastic Package Availability (PPA) Program is to investigate the ability of various PEM technologies to withstand the stresses of military

operating environments. The program is sponsored by the Defense Logistics Agency, with management participation by each Service and by NASA. The prime contractor is National Semiconductor.

The PPA Program uses a "design of experiments" approach wherein two IC types — a device with a low lead count and a device with a high lead count — and a sensor chip are packaged in a number of configurations and run through a number of tests.[11] The PEM configurations include three package types and eight mold compounds. Two ceramic packages serve as controls. Each IC is tested for, among other parameters, highly accelerated stress, storage at high temperature, the product's operational life, and its ability to withstand temperature cycling. Test results will be useful in comparing commercial technology capabilities with military environments. Where shortfalls are observed, the program may also examine how the commercial technologies, such as mold compounds, can be modified to improve military performance.

Work on the PPA Program started in late 1992 but was delayed until mid-1994 because of a lapse in government funding. Results are due by the end of 1995.

A Proposal: The Center for Commercial Integrated Circuits Insertion

Were R&D projects that study the military functionality of commercial ICs, such as the Microprocessor Technology Utilization Program, coordinated with programs that study the ability of commercial ICs to withstand military operating conditions, such as the PPA Program, DoD would increase its ability to use commercial ICs with confidence. Although the technical experts involved with these projects confer (e.g., at workshops), research is not formally coordinated.

We recommend that DoD establish a Center for Commercial IC Insertion (CCII) to coordinate this research and to disseminate the results. The charter for the CCII should include

- defining the overall (DoD-wide) research agenda and funding requirements;
- coordinating R&D, that is, allocating funding and evaluating research proposals (projects could be administered by the Services as they are today);
- helping program offices develop IC requirements and review bidders' specifications; and
- acting as a clearinghouse for project information and R&D results.

Presently, each organization — a weapons program office or contractor — wishing to learn of research results in this area must individually contact a multitude of programs, providing these programs can be identified.

Several alternatives are available for organizing the CCII. The CCII could be operated internally, e.g., by a Service laboratory. This would facilitate up-front securing of funding and technical support to program offices. Such an arrangement would require only a small central staff and could draw on existing Service engineers in their current billets. Another option is to award operation of the CCII to a private, nonprofit research institution specializing in electronics. This option has the benefit of more effective dissemination of R&D planning and results. As a model of how a private institute might operate, we suggest (without implying partiality) the Semiconductor Research Corporation. The third option, which we recommend, is a hybrid organization that draws on the strengths of the public- and private-sector alternatives. This organization would consist of government management activities combined with technical support and technology dissemination from nonprofit contractors.

As we stated previously, design conservatism, caused by a lack of information, is limiting the use of commercial ICs in military systems. A CCII would make better use of DoD's funds for IC-insertion R&D and would provide more program offices and defense contractors with the data they need to determine when commercial ICs can be used with confidence, and when they should be avoided.

STANDARDS AND SPECIFICATIONS

Some MILSPECs have been criticized as being overly prescriptive and technically obsolete. Where they dictate special management practices and record keeping, MILSPECs tend to segregate companies into defense and commercial operations and to steer purely commercial firms away from defense business.[4] Where they dictate obsolete product designs or manufacturing methods, MILSPECs create a "second tier" of defense producers, dedicated to the MILSPEC methods, while commercial technology forges ahead.

The Perry memorandum, "*Specifications and Standards – A New Way of Doing Business*" (described in Chapter 1), launched the initiative for MILSPEC reform. Secretary Perry desired swift action but also stated that this reform should not disrupt programs already underway. He permitted Component Acquisition Executives to waive the reform for six months and stated, "it is not my intent to disrupt ongoing solicitations or contract negotiations."[2]

Implementation of MILSPEC reform by the Services has been swift and pervasive. Initially the Services, especially the Army, banned almost all MILSPECs from use in contracts regardless of the function of the MILSPEC, the criticality of the system being procured, or the system's stage in the development cycle. Recently, however, DoD has undertaken a more rational approach. OSD has commissioned a team to review the most onerous MILSPECs, and that team is

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[4]Other important factors driving commercial firms away from defense business are DoD's procurement practices, described in Chapter 3.

conducting a systematic review, including looking for commercial replacements. The Air Force and Navy have granted Service-wide waivers permitting the use of certain MILSPECs in contracts. The program offices charged with developing system requirements, however, face a daunting task in replacing most MILSPECs, as neither the time nor the money has been budgeted for the required analyses. We discuss MILSPEC reform more broadly, including giving our recommendations for effective and economic program office implementation, in Appendix B.

The intent and general direction of MILSPEC reform is good. Properly implemented, it will lower purchase cost by removing unnecessary or obsolete requirements embedded in MILSPECs. It will permit contractors to use innovative design techniques or advanced technology in areas where commercial advances exceed the military's. With concurrent relief from burdensome procurement practices, MILSPEC reform will broaden the defense industrial base to include contractors who do not presently serve defense. If poorly implemented, however, the reform will eliminate not only a MILSPEC (such as MIL-STD-973, *Configuration Management*) but also the associated activity – such as configuration management, which may be critical to complex systems development – from the contractual relationship between government and industry. We endorse an approach that reviews each program requirement and associated MILSPEC on its merits, rather than an approach that simply measures success by how few MILSPECs are placed on contract.

Military Standards and Specifications Pertaining to Integrated Circuits

Figure 2-2 describes the general process flow and MILSPECs pertaining to IC selection, design, and manufacture for military use. The figure shows that MILSPECs serve many different purposes. The MILSPECs in the figure are those that existed in 1994 when the Perry memorandum was issued. Where appropriate, we describe the impact of MILSPEC reform on those documents.

As Figure 2-2 shows, contractual system performance requirements (box 1) lead to IC device requirements (box 2). Device requirements include not only functionality but also the operating environment and support issues. If the contract includes MIL-STD-454N, (box 3), Requirement 64, *Microelectronic Devices*, of that standard dictates that military ICs must be used.[5] Otherwise – or if the contract includes MIL-STD-970, *Specifications and Standards, Order of Preference for* – the contractor is free to choose a commercial part.[6] Commercial ICs are frequently eliminated from consideration because insufficient data exists supporting their ability to operate in the military environment (box 4). If the commercial device does suffice, the contractor may buy it (box 5).

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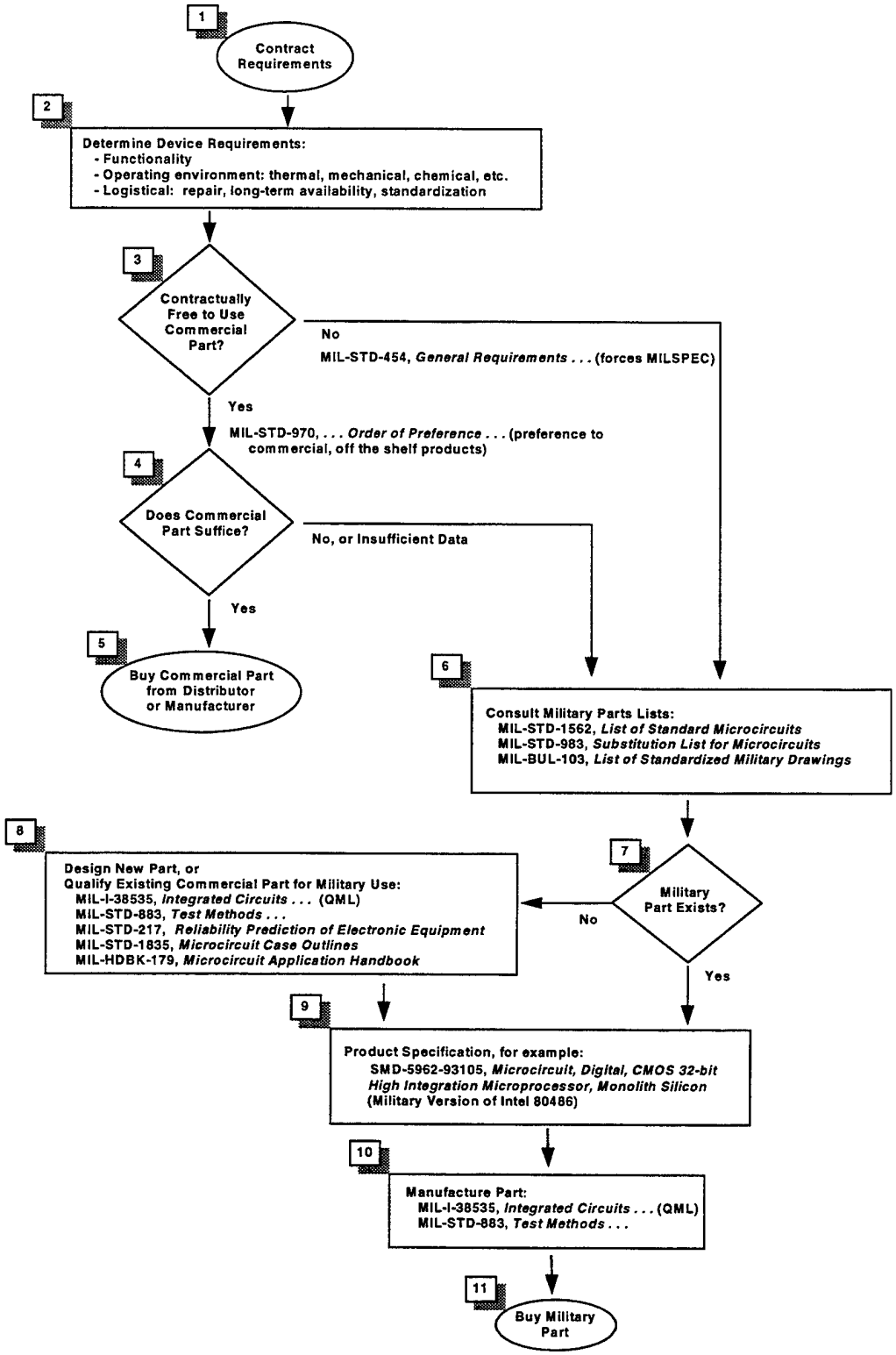
[5]Under MILSPEC reform, MIL-STD-454N is slated to be replaced by a military handbook.

[6]This standard has been canceled recently.



Note: The numbered shapes in the figure are described in the text.

Figure 2-2.

Role of Major MILSPECs in Integrated Circuits Part Selection, Design, and Manufacture

Before using a military part, a contractor first must consult a military parts list (box 6). This is done to control the proliferation of parts in the supply system and attendant inventory costs. MIL-STD-1562W, *List of Standard Microcircuits,* lists older parts qualified for military use under the now-defunct qualified parts list system. MIL-BUL-103, *List of Standardized Military Drawings,* lists newer parts qualified for military use, including militarized versions of commercial ICs. MIL-STD-983A, *Substitution List for Microcircuits,* cross-references military part numbers to commercial or generic part numbers.[7]

If a military part does not exist to do the job (box 7), the contractor must design a new device or qualify an existing commercial device for military use (box 8). A number of MILSPECs apply explicitly and implicitly to that activity. MIL-I-38535B, *Integrated Circuits (Microcircuits) Manufacturing, General Specification for,* outlines quality assurance provisions and is discussed in more detail later in this chapter.[8] MIL-STD-883D, *Test Methods and Procedures for Microelectronics,* implicitly defines many IC performance requirements by prescribing the electrical, thermal, mechanical, and chemical tests that devices must pass. MIL-HDBK-217F, *Reliability Prediction of Electronic Equipment,* provides mathematical model for reliability prediction. MIL-STD-1835A, *Microcircuit Case Outlines,* defines standard form and fit (electrical lead configurations) for connecting ICs into circuit boards. MIL-HDBK-179(ER), *Microcircuit Application Handbook,* is a relatively new document that aims to help IC users define quality assurance provisions and select devices that best meet the required performance.

When a new military part is designed, or a commercial part is qualified for military use, a product specification called a standard microcircuit drawing (SMD) is prepared (box 9). SMDs are usually prepared by the IC manufacturer but can also be prepared by the IC user or by the government. Since commercial IC manufacturers can change product specifications at will and without notice, the SMD provides a baseline or stable product definition. We discuss SMDs in more detail later in this chapter. The SMD we have chosen for our example corresponds to the military version of the Intel 80486, a microprocessor used in many commercial PCs.

During product manufacture (box 10), MIL-I-38535B and MIL-STD-883D are the two main MILSPECs that apply. These MILSPECs influence both the design and production of ICs. Contrary to popular perception, however, MILSPECs do not prescribe manufacturing methods for ICs. Finally, the product resulting from this flow is considered a military part (box 11).

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[7]A part may have a generic number, a source control number, a national stock number, and a military number.

[8]MIL-I-38535B has been superseded by a "performance specification," MIL-PRF-38535C, of the same title. To maintain continuity in the text, we describe this specification using the MIL-I-38535B designation. All citations, however, are from the more current MIL-PRF-38535C.

Military Standards and Specifications That Raise Barriers

DoD, in particular the Defense Electronics Supply Center (DESC), has made significant progress in the last seven years in improving the MILSPECs relating to ICs. Notably, MIL-M-38510J, *Microcircuits, General Specification for*, which required domestic sourcing and non-value-adding testing, has been replaced by MIL-I-38535B. Several MILSPECs, however, remain in common use and inhibit the use of commercial ICs in applications where they might be desirable. The two principal MILSPECs raising barriers are MIL-STD-454N and MIL-HDBK-217F. The use of these two MILSPECs should be greatly reduced by Secretary Perry's reform initiative.

MIL-STD-454N is actually a series of 76 requirements documents for electronics and related hardware. Requirement 64, "Microelectronic Devices," establishes criteria for the selection and application of ICs. That requirement "... includes the order of precedence by which an equipment developer must select microcircuits; only a military-approved part is permitted."[6] Nonmilitary parts are the last preference and require government approval. Requirement 64 also severely restricts the use of PEMs:

> Microcircuit devices used in equipment shall be hermetically sealed in glass, metal, or ceramic (or combinations of these) packages. No organic or polymeric materials such as lacquers, varnishes, coatings, adhesives, or greases shall be used inside the microcircuit package, unless otherwise specified. ... Upon specific request and approval by the procuring activity to waive the requirements ... non-hermetic microcircuits may be considered for use in ground fixed or ground benign environments as defined in MIL-HDBK-217.[12]

MIL-HDBK-217F provides mathematical models for reliability prediction. The handbook contains 19 sections, each corresponding to a different type of electronic equipment. Section 5 provides models for microcircuits, gate/logic arrays, and microprocessors. The handbook's models are parametric; that is, they take as input features of the device and, through a formula, predict a failure rate. For example, the reliability model for microprocessors is as follows:[13]

$$\lambda_P = (C_1\pi_T + C_2\pi_E)\pi_Q\pi_L,$$

where

- λ_P = predicted failures per 10^6 hours,
- C_1 = the number of bits and transistor technology,
- π_T = junction temperature and transistor technology,
- C_2 = the number of pins and package type,
- π_E = the operating environment,
- π_Q = the quality screening performed, and
- π_L = a learning factor, based on years of production.

Note that the parameters that form the reliability equation are not directly measured values but rather are qualitatively assigned and unitless. For example,

the factor for the "Naval, Sheltered" operating environment is 4.0 and that for "Naval, Unsheltered" is 6.0.

Clearly, much analytical work goes into producing such predictive models. The models' drawback, however, is that they are static, while the technologies they address change with time — often rapidly. Materials, designs, and manufacturing processes are evolving rapidly for ICs. New technologies with attributes that fare poorly in the models (such as being in production for only a few years) may well have actual reliability far in excess of the predicted values. Some reliability experts argue that the handbook's models are biased so that only ceramic-encapsulated ICs score well.[6] Program managers and contractors might therefore believe that they take on risk by choosing PEMs or other commercial IC technologies.

Beneficial Practices Based on Military Standards and Specifications

For ICs, MILSPEC reform predates the Perry memorandum and can, in fact, be traced to Secretary Perry's participation in the 1986 Defense Science Board study on microelectronics. Unfortunately, the current initiative that seeks to reduce onerous and obsolete MILSPECs may also reduce or eliminate MILSPECs that have been the subject of review and improvement in recent years and that are beneficial to military procurement.

Two government initiatives, the QML Program and the SMD Program, help ensure that the ICs in military systems are of high quality and help control logistics support costs. These programs save the government money and, while not perfect, do not raise major barriers to the insertion of commercial ICs. They also do not have commercial analogs covering the range of products that DoD buys. Nevertheless, these programs are threatened with effective elimination because the documents describing them are MILSPECs.

Both the QML Program and the SMD Program are administered by DESC. Where appropriate, we suggest improvements to the underlying MILSPECs to make them more performance oriented and to reduce minor barriers to commercial ICs.

The Qualified Manufacturers List Program

The QML Program provides a standard approach to ensuring the quality of ICs used in military systems. It establishes a procedure for assessing manufacturing quality practices of IC suppliers that can be used by all IC users serving defense (as well as those not serving defense but requiring military-like quality assurance, parts control, and supplier documentation). The QML approach includes commercial-like "process control" provisions and eases former military restrictions on offshore production.

Basis in MILSPECs

The QML Program is defined by MIL-I-38535B, and extensively references MIL-STD-883D. DESC first implemented the QML Program in 1989 after numerous recommendations by industry and defense review panels. Several of the previous reports' recommendations regarding the program are listed in Appendix A. The QML Program replaces the Qualified Parts List (QPL) Program – which was based on MIL-M-38510J, *Microcircuits, General Specification for,* and required quality assessment of each part. In addition to qualifying suppliers' manufacturing processes rather than individual parts, the QML Program gives IC manufacturers much greater freedom to upgrade their processes flows than did the QPL approach. The QML Program also gives IC manufacturers relief from previously mandatory testing, as stated in MIL-PRF-38535C: "If sufficient quality and reliability data is [*sic*] available, the manufacturer, through the QM [quality management] program and the manufacturer's review system, may modify, substitute, or delete tests."[14]

Under the QML Program, DESC assesses an IC manufacturer's ability to consistently produce parts that meet design specifications. To do this, DESC assesses the "process flow" – materials, device technologies, and manufacturing steps – that the manufacturer would like to use to supply ICs for military applications. Suppliers are also assessed according to their ability to maintain consistent quality as they change their process flow (to adopt new technologies or incorporate lessons learned). Those IC suppliers passing the audit are listed on the QML. Products from QML-listed suppliers can be used with confidence by defense original-equipment manufacturers (OEMs) without the need for additional quality oversight.[9] While oriented to defense, the QML Program does not require that a contractor's commercial production be separated from its military production. Rather, the program provides a means for satisfying military quality requirements regardless of the ultimate use – commercial or military – of the products emerging from the contractor's manufacturing line.

The QML assessment replaces similar audits that would be performed by each defense contractor using ICs (of each manufacturer from whom they buy ICs). Such audits are routinely conducted in the commercial sector, with the result that IC manufacturing plants experience a parade of customers assessing the operations. For example, the Texas Instruments plant in Kuala Lumpur hosts about one customer audit per month.[15]

Commercial-Like Practice

The QML Program satisfies the requirement in Secretary Perry's directive to replace military-unique quality assurance techniques with "process control." As defense suppliers move away from the traditional approach of MIL-Q-9858, *Quality Program Requirements,* toward the commercial International Organization

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[9]As in the commercial sector, however, defense IC users rely on third-party testing and incoming inspection in cases in which the cost of failure is high.

for Standardization's ISO 9000 series standards, they will also need an industry-specific quality system.[10] The ISO 9000 standards are simply too generic to be used alone by any given industry. For example, ISO 9000 requires the following for design changes: "The supplier shall establish and maintain procedures for the identification, documentation, and appropriate review and approval of all design changes and modifications."[16] The QML Program builds on this for the IC industry, first by requiring a technology review board (TRB) to monitor design and process changes and, second, by more explicitly explaining the ISO 9000 requirement for design changes:

> Changes in the design methodology to be evaluated by the TRB will include, but not be limited to, changes in the following areas:
>
> a. Technology data base (cell/design library).
>
> b. Design flow.
>
> c. Design system (computer aided design (CAD), design rules).
>
> d. Software updates.
>
> e. Model or modeling procedures.
>
> f. Configuration management.
>
> g. Radiation hardness assurance (if applicable).
>
> h. Electrical performance.[14]

DESC is conducting a pilot ISO 9000 registration program. In conjunction with the QML audit, DESC offers to certify an IC manufacturer's compliance to the ANSI/ASQC Q91, *Quality Systems – Model for Quality Assurance in Design/ Development, Production, Installation, and Servicing,* at government expense.

One major industry criticism of the former QPL Program was that it required domestic production. The QML Program, in contrast, has required domestic wafer fabrication but permitted foreign packaging and assembly. This is in response to the fact that many U.S. chip manufacturers do their commercial packaging and assembly in company-owned plants in Asia. Industry continues to push for permission to fabricate wafers offshore. The March 1995 revision of MIL-I-38535B (renamed MIL-PRF-38535C), *Integrated Circuits (Microcircuits) Manufacturing, General Specification for,* removes the explicit requirement to fabricate wafers domestically and introduces the concept of a presumably domestic "basic plant" from which offshore operations are monitored and directed.[14] DoD should not forget, however, that foreign sources, even if domestically owned, are subject to supply disruptions in time of war.

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[10]In the United States, the ISO 9000 series standards are defined by American National Standards Institute (ANSI) and American Society for Quality Control (ASQC) standards. For an overview, see ANSI/ASQC Q9000-1-1994, *Quality Management and Quality Assurance Standards – Guidelines for Selection and Use.*

Although no single commercial standard is analogous to MIL-I-38535B, we are aware of several systems that are. Commercial IC users use rigorous procedures for ensuring the quality of ICs they buy. The Boeing Commercial Aircraft Company, for example, buys its ICs through third-party test laboratories. Boeing requires those laboratories, in turn, to buy ICs only from Boeing-approved vendors. In 1994, five years after the QML Program was introduced, the automotive industry issued its standards — CDF-AEC-A100, *Quality System Assessment for Semiconductor Suppliers,* and CDF-AEC-Q100, *Stress Test Qualification for Automotive-Grade Integrated Circuits.* With some differences (discussed below in our recommendations), these new standards are analogous to MIL-I-38535B and to MIL-STD-883D, respectively. The Joint Electron Device Engineering Council (JEDEC) of the Electronic Industries Association (EIA) is planning an analogous standard for consumer-grade ICs.[17] Other than these emerging standards, commercial specifications for quality assurance and environmental testing mainly are set company by company.[11] We discuss the IC-procurement and quality-management practices of Boeing and the commercial automotive industry in more detail in Appendix C.

Improving the QML Program

The QML Program should be maintained and improved at least until a single commercial replacement is put in place or until a broad enough range of commercial industries adopt QML-like practices, as the commercial automotive industry has. Managing quality assurance on a company-by-company basis is inefficient and expensive, and foregoing quality assurance is risky. Consider Table 2-5, which was prepared by an industry group advocating the military use of commercial ICs. Note that in only one category — "protected" — did this group recommend that commercial ICs be used without some special consideration. The QML Program provides one option for such consideration.

We recommend that the QML Program stand on its own merits. DESC should certify IC manufacturers who choose to participate and should encourage participation. However, not all commercial suppliers potentially serving defense may opt for QML certification. While MIL-I-38535B, and MIL-STD-883D should not be prohibited in defense contracts, neither should they be mandatory. Defense contractors should be free to procure ICs (in whatever performance grade is appropriate, from consumer grade through space grade) from a non-QML source. Where contractors choose not to use the quality assurance practice of the QML Program, they should be required to use a nationally recognized alternative (such as CDF-AEC-A100) or to demonstrate to the government that their company-unique practice is acceptable (and, on negotiated-price contracts, cost-effective).

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[11]The JEDEC does maintain device configuration and environmental test specifications that are widely used commercially. These are also referenced in MIL-STD-883D and are listed in the *EIA, JEDEC, and TIA Standards and Engineering Publications 1994 Catalog.*

Table 2-5.
Integrated Circuits Operating Environments and the Need for Special Testing

Operating environment	Need for special testing or handling of commercial ICs
Protected	No
Normal, readily repairable	Yes
Normal, inhabited	Yes
Uninhabited	Yes
Hostile	Essential
Space	Essential

Source: The Multi-Use Manufacturing Work Panel of the Industry Task Force for Affordability and The Institute for Defense Analyses, "Accelerating the Use of Commercial Integrated Circuits in Military Systems," Interim Report, September 1994, p. 10.

The links, or overlaps, between MIL-I-38535B and MIL-STD-883D are numerous and confusing. DESC should modify the two documents, following the example of the automotive industry, and separate the procedures for the quality assurance program from the environmental operating requirements. In its March 1995 revision, DESC did take steps in this direction and eliminated the requirement that, "Unless otherwise specified, all devices produced under this specification shall have an operating temperature range of -55°C to +125°C."[18] In its place, the new performance specification states, "Devices produced under this specification may have any operating temperature range (case, ambient, or junction) as long as it is specified in the device procurement specification."[14] The new document, however, still references specific tests in MIL-STD-883D, for example, requiring that all hermetic devices be capable of withstanding 50 cycles, from -65°C to +150°C.[14,19] This kind of requirement should be tied to an operating environment and should be stated in MIL-STD-883D, and MIL-I-38535B should be further revised to define only device-independent quality assurance procedures.

MIL-I-38535B also should be reviewed for any end-item marking or packaging requirements that differ from commercial practice. These requirements should be made optional except in circumstances where piece-part traceability is required. In those circumstances, the government should expect to pay more for the parts (as the "premium" for obtaining part traceability "insurance").

We recommend that MIL-STD-883D be reviewed and modified to establish IC performance specifications for common military applications. That specification should draw on existing definitions of military operating environments and should incorporate new ones that are developed on the basis of our recommendations in the section on design conservatism. MIL-STD-883D should include a cross-reference to test methods by operating-environment class. Currently, the standard is organized by test method. No easy way is available to access the tests required for a given level of performance.

Implicit in these recommendations is the need for separate designators for quality assurance practice and environmental qualification. Currently, Class Q refers to QML parts qualified for nonspace use and Class V refers to QML parts qualified for space use (other IC devices classes exist as well). This practice is confusing. We recommend that one designator be defined to reflect the quality assurance scheme under which a part was made and that a separate "environmental class" designator be defined to indicate the operating conditions under which the part is qualified to operate. Then, for example, a "Q1/GB" part might be one produced in a QML factory and qualified to operate in a "ground, benign" environment, and a "Q2/GB" part might be one produced in a non-QML factory but also qualified (by a procedure other than QML) to operate in a "ground, benign" environment.

THE STANDARD MICROCIRCUIT DRAWING PROGRAM

An SMD defines the performance characteristics and quality assurance provisions for an individual IC or family of IC devices, regardless of the manufacturer. SMDs can be prepared by IC manufacturers, OEMs, or DESC. SMDs originated in 1976 with the F-16 aircraft parts-control program and are managed by DESC. SMDs depend on MILSPECs for format and application. The format for SMDs is defined in MIL-HDBK-780, *Standardized Military Drawings*. MIL-BUL-103, *List of Standardized Military Drawings*, is a catalog of SMDs with cross-references to generic part numbers where they exist.[12]

The SMD relieves the IC user (typically an electronic-system integrator, called an original equipment manufacturer, or OEM) of the obligation to develop specifications for each IC it uses. OEMs and the government also use technical specifications to procure ICs and to track hardware configuration over time. Such specifications could conceivably be eliminated in favor of using the IC manufacturer's specification. Commercial practice, however, is that IC manufacturers change specifications at will, without necessarily assigning a new part number and without necessarily notifying the customer (especially when the IC user buys through a distributor and is invisible to the manufacturer). The SMD Program requires the manufacturer to notify DESC of changes so that the SMD can be kept current.

A single SMD can accommodate a variety of quality assurance levels. For example, an SMD can include a Class M device, which indicates vendor self-certification to the nonspace performance requirements of MIL-STD-883D; the same SMD can also include a Class Q device and Class V device, which indicate the vendor is certified to the quality specification level of MIL-I-38535B. When several vendors supply a generic part, they will be listed together in a single

[12]Although the standards use the word "military," the name of the program has been changed to use the word "microcircuit," putting emphasis on the products covered.

SMD. As of August 1994, DESC reported the following statistics for the SMD Program:

- The number of SMDs issued is 2,180.
- The SMDs specify 11,106 part types (each SMD can have multiple part variations).
- The number of companies making SMD parts is 86.
- The number of companies using SMD parts is 133.
- The average SMD development time is 2.1 months.[20]

The SMD Program benefits DoD in two ways. First, a DoD-wide specification for a given product (which can be "military" or "commercial") is developed only once. Without the SMD, that specification will be developed, perhaps more than once, by each OEM using the device; and, in each instance, each OEM doing the developing is being paid by the government. Second, each OEM specification, called a source control drawing (SCD, because it is developed and controlled by the government's source, the OEM), results in a national stock number (NSN) in the DoD supply system. Therefore, a given IC would result in numerous SCDs and duplicate NSNs. Duplicate NSNs not only tax the inventory management system but also cause both excess inventory and supply disruptions. According to DESC, the proliferation of SCDs has resulted in each unique IC having an average of four NSNs in the government supply system. To illustrate this proliferation, DESC provided the example shown in Figure 2-3.

Parts control and configuration management facilitate supporting a system throughout its operating life. Parts control helps to avoid having multiple manufacturer's part numbers for the same item. Assigning a single part number to a part facilitates identifying nondevelopmental items that are already in the inventory. The SMD provides parts control among ICs. If DoD eliminates the SMD Program, part numbers will proliferate, causing purchase volumes to fall and unit prices to rise. This may be partially offset by changes in IC configuration management.

Configuration management maintains the form, fit, and function specifications of a part or item. Secretary Perry's memorandum states that the government should maintain configuration control of functional and performance requirements while leaving design to the manufacturer. A 1994 Air Force study recommends that, for ICs, configuration control should be at the circuit-board level not the IC-part level.[13] [21]

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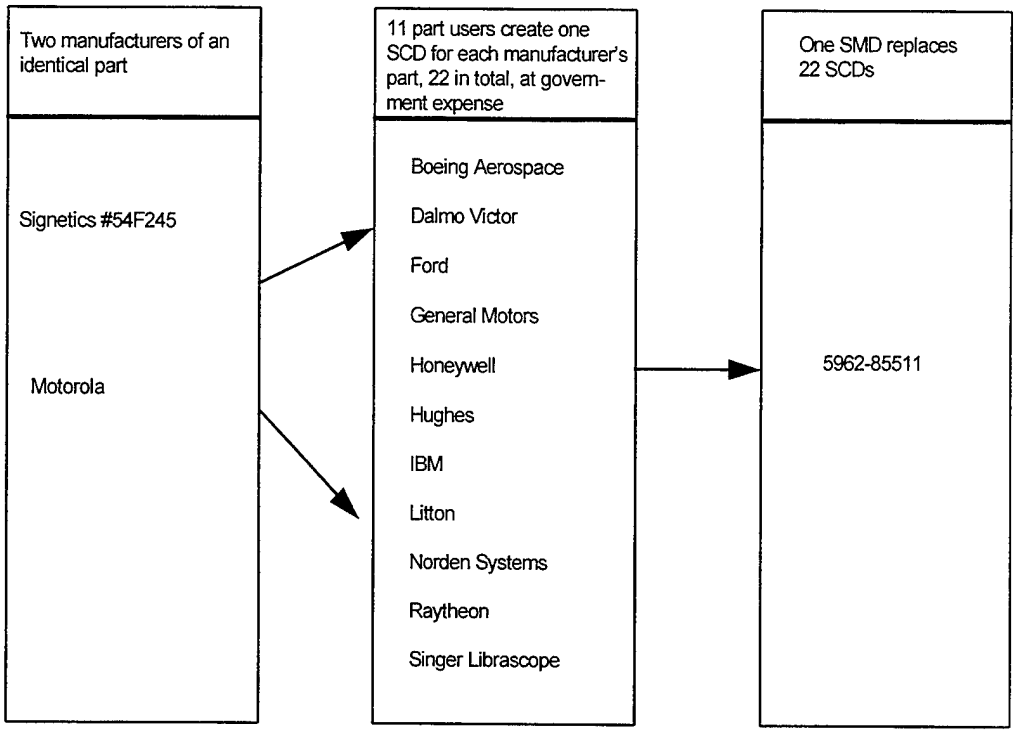
[13]This recommendation is economically effective when the cost of the ICs on the board is below a certain threshold.



Source: Interview with Mr. Mike Frye, DESC, 12 October 1994.

Figure 2-3.
SMDs Reduce Proliferation of Part Numbers

The SMD Program has its basis in MILSPECs and is threatened if the MIL-SPECs that define it are eliminated. We recommend that this program be retained intact. To those manufacturers who choose to participate in the QML Program, the SMD provides an easy vehicle for providing a specification document for devices produced in a QML factory.

SUMMARY

In this chapter, we have discussed the technical barriers to inserting commercial ICs in military systems. The principal barrier is design conservatism caused by a lack of precise environmental requirements and device specifications. To reduce this barrier, we recommend that DoD expand its categories of environmental requirements to include its applications that are similar to commercial applications. We also recommend a comprehensive DoD effort to collect data on the ability of commercial ICs to operate in military environments, including environments that may be outside the devices' published design specifications but for which the devices may have been privately qualified. A CCII could oversee research in this area and could serve as a clearinghouse for dissemination of project results.

Other technical barriers are imposed by the use of unnecessary MILSPECs. We identify MIL-STD-454N, and MIL-HDBK-217F as inhibiting commercial IC use and feel their use will be reduced, justifiably, by the MILSPEC reform initiative. Not all military standards and specifications present barriers, however, and some good ones are threatened by the current reform initiative. Two beneficial programs related to ICs, QML and SMD, are based in MILSPECs that have no direct commercial analogs. We recommend these programs be retained and improved. We also recommend that using the QML Program be made contractually optional, but that contractors who choose not to use it be obligated to substitute an acceptable approach to quality assurance.

CHAPTER 3

Administrative Barriers

One of the factors that inhibits the participation of commercial IC suppliers in government markets is the manner in which the government does business with its suppliers. Clauses included in government contracts, and that flow down — either by direction or as a matter of prime contractor practice to lower-tier subcontractors — often call for practices, procedures, or agreements that differ significantly from those found in commercial business dealings. These clauses can also subject contractors and subcontractors to levels of oversight and to potential liabilities that they may be unwilling to bear merely to do business with the Federal government.

The Federal Acquisition Streamlining Act of 1994 (FASA) is intended, among other purposes, to facilitate government acquisition of goods and services from the commercial marketplace by expanding the definition of what constitutes a "commercial item" and by exempting transactions for such items from some of these government-unique laws and regulations. Regulatory initiatives intended to implement FASA are in various stages of completion, with some proposed rules already out for public comment and others still in the development and internal-coordination stages.[1] While both FASA and its regulatory implementation will make some major changes in the manner in which the government contracts for commercial items, a host of unique laws and regulations will remain that can have a chilling effect on the desire of commercial firms to become involved in prime contracts or subcontracts with the government.

We analyzed the government's practice of requiring specific solicitation provisions and contract clauses set forth in the regulations. We also assessed the effect of the government's way of doing business with commercial firms providing commercial items in military systems. These commercial firms may be involved at either a prime contract or subcontract level. In some cases, the subcontractor may be several levels beneath the prime contractor and still have to deal with these solicitation provisions and contract clauses. We used a unique data base of the contract clauses contained in the FAR and the DFARS that LMI has developed as a part of its ongoing research programs in acquisition. We concentrated on those clauses that flow down from the prime contractor to the

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[1]Full FASA implementation will require changes and additions to be made to both the Federal Acquisition Regulation (FAR) and the Defense FAR Supplement (DFARS). In accordance with a plan approved by the Office of Federal Procurement Policy (OFPP), all implementation efforts will be focused initially on the FAR. Necessary or appropriate DFARS implementation language will be added, and implementation actions will take place only after all FAR changes are finalized. As of the time of writing, the implementing FAR actions are incomplete.

subcontractor either because of direct statutory or regulatory mandate or because of the prime contractor's need for information to comply with a provision that nominally applies only at the prime contract level (i.e., even though a particular clause may not contain a mandatory flowdown requirement, compliance with it by a prime contractor may create an "effective" flowdown of some or all of the burden to those firms with which the prime does business under the contract).

Another facet of the flowdown of clause requirements that must be acknowledged but cannot be directly analyzed is the practice of a prime contractor's including clauses or requirements in its subcontracts that are not *required* by the terms of its contract but are, nevertheless, passed on to the subcontractor. As a result, the actual environment that a government subcontractor may face can be significantly different from that which might be surmised from merely examining the underlying laws and regulations. Thus, additional barriers can arise, and existing barriers can remain, that are not anticipated or directly addressed by acquisition reform initiatives or regulatory attempts to make government business practices less onerous to commercial firms.

While the solicitation provisions and contract clauses set forth in the FAR and DFARS may appear to be the primary contractual impediments to using commercial firms and products, they are by no means the only potential barriers. Those portions of a government contract that define and describe the data to be delivered can vary significantly from comparable portions of a commercial contract. Many government data requirements are detailed and specific concerning the format, content, and frequency of submission; the mere presence of these data items in a contract can turn an otherwise benign transaction into one that is more costly to perform than similar sales of commercial parts. Data requirements can originate in the prime contract or arise from the approach used by the prime contractor in dealing with its suppliers. Unlike the standard contract clauses, the presence of these requirements in government contracts is not due to regulatory or statutory prescription but rather to the decisions of the technical personnel involved in the program or project. Thus, the task of finding and limiting such data requirements is much more difficult than identifying clauses that create barriers. The potential effect on the government business environment as perceived by commercial firms, however, is no less important or pervasive.

Our review of the clause data base showed a total of more than 200 clauses that flow down to subcontractors and, of that total, more than 100 that can present barriers to commercial firms. We supplemented the clause review with industry interviews regarding government contracting procedures. On the basis of these efforts, we identified 32 clauses (not counting alternates separately in the total) that may be particularly burdensome for commercial firms. These clauses can be grouped into six categories for presentation and evaluation. The categories are cost or pricing data, cost collection and reporting, source restrictions, data rights, socioeconomic requirements, and precious and specialty metals. In Appendix D we present each clause on a single page that describes the substance of the clause, its statutory or regulatory basis, its flow-down extent, a brief description of its impact as a barrier, a summary of the effect that FASA has on it,

and a recommendation concerning what actions could be taken to lessen or eliminate its burdensome impact. The following sections summarize the subject matter of these clauses on the basis of the categories into which we placed them.

COST OR PRICING DATA

Among the items most frequently identified by commercial firms as barriers to doing business with the government are those provisions and clauses that require a contractor or subcontractor to disclose detailed accounting and financial information, called "cost or pricing data," as a part of a proposal, and the concomitant access to records by government or higher-tier contractor personnel. Table 3-1 lists the nine contract clauses that collectively comprise cost or pricing data requirements. These clauses implement the Truth in Negotiations Act (TINA, codified at 10 U.S.C. 2306).

Table 3-1.
Cost or Pricing Data Contract Clauses

FAR/DFARS reference	Clause title
52.214-26	Audit — Sealed Bidding
52.214-28	Subcontractor Cost or Pricing Data — Modifications — Sealed Bidding
52.215-1	Examination of Records by Comptroller General
52.215-2	Audit — Negotiation
52.215-24	Subcontractor Cost or Pricing Data
52.215-25	Subcontractor Cost or Pricing Data — Modifications
52.216-5	Price Redetermination — Prospective
52.216-6	Price Redetermination — Retroactive
52.244-2	Subcontracts (Cost-Reimbursement and Letter Contracts)

Commercial firms typically are not asked to and do not, as a matter of policy, disclose such sensitive financial information to commercial customers, and they fear both the administrative burden and the potential confidentiality compromise that such a practice may entail. Not only does TINA require a full disclosure, but there are also potential civil and criminal sanctions associated with incomplete or incorrect disclosure. For example, an error or mistake may be misconstrued as "defective data" for which criminal and civil penalties exist. This criminalization of the procurement process has forced firms that have historically operated in both the government and commercial marketplaces to separate their operations and record keeping into government and commercial units. By separating government and commercial accounting, the company precludes

total access to its complete financial records and ensures that its potential liabilities are contained in organizational units that are set up and staffed to comply with the government's unique requirements.

In the case of ICs, since the government's direct and indirect demand is such a small and declining portion of the total market, such specialized government requirements eventually will present firms with a choice either of continuing to maintain unique structures and staffs that have no commercial benefits or of ceasing to actively seek government business. Still more troubling is the fact that, as the IC industry focuses more on the larger commercial markets, firms that may offer new technologies and good prices will shun opportunities to sell to relatively small government programs that cannot deal with them in the same manner that their other, larger customers do. The end result could be fewer effective competitors for government business, higher prices from those few remaining competitors, and potentially long delays in achieving access to the newest and most advanced products, processes, and technologies.

This is one of the areas that FASA addressed and revised most significantly. While contracting officers (COs) still need to establish price reasonableness of the commercial items being purchased, the requirements to collect cost or pricing data are eased and less of a burden is placed on the firm providing the product. FASA set up a hierarchy of data types to be used by COs to establish price reasonableness, with detailed cost or pricing data the last in order of preference.

Proposed rules relating to TINA do, however, impose the following potential conditions on government purchase of commercial items:

- An item qualifies for an exemption to submitting certified cost or pricing data if it is sold in substantial quantities and if sales at catalog prices are at least 25 percent of the total sales of the item.

- An offeror must present examples of the lowest prices at which the commercial item was sold.

- If actual sales differ significantly from the estimates on which the contract was based, the government may reduce the price after contract award.

- External, independent sources must provide data on the market prices of a commercial item.

These proposed rules are inconsistent with the intent of FASA, and industry groups have made comments to that effect to the FAR Council. Thus, these barriers may be reduced by the Federal rule-making process. When the final rules are implemented, they will apply at both the prime contract and subcontract levels.

Although the barrier of submitting certified cost or pricing data may be reduced for commercial items in the proposed rules implementing FASA, another related barrier remains — government audits. As mentioned previously, the CO must determine that the price paid for a commercial item is

reasonable and, in doing so, may request information from the contractor or subcontractor. When the contractor or subcontractor provides information to the CO, that information may be audited for up to two years after the date of contract award (or contract modification). Such audit rights are not a commercial practice and create a barrier to commercial firms. Thus, although the requirement to provide certified cost or pricing data has been effectively removed, the government's audit right remains as a barrier and the contract provisions and clauses are included in Appendix D for that reason.

In any event, FASA has reduced most of the negative impacts of these cost and pricing clauses so that they can now be considered, at most, to be minor. The final rules, and the practical approach adopted by the procurement community in their implementation, will determine the actual resolution of this issue of providing cost or pricing data. Individual buying offices may vary in their interpretation and application of the final rules and may request certified cost or pricing data, although it is improper for them to do so, because many have come to rely on the certified data to establish price reasonableness.

COST COLLECTION AND REPORTING

Closely related to, but distinct from, the previous category is the series of special clauses and requirements that define the kind of accounting systems and procedures that firms must use when doing business with the government and the specialized cost reporting that must be done under certain major system programs. The specific clauses included in this category (shown in Table 3-2) are those that address cost/schedule control systems criteria (C/SCSC), used on major system acquisitions. This requirement mandates highly specialized cost-collection and report-generation capabilities, including planning, budgeting, and scheduling procedures that have neither close counterparts nor business value in a commercial setting. When DoD's demand was a major factor in the IC market, firms may have been willing to accept these kinds of requirements as a part of the "price" of access to this market. However, given DoD's now minor role in today's IC marketplace, in both absolute and relative terms, this detailed accounting and program management system creates an additional cost that firms endeavoring to be competitive will seek to reduce or eliminate altogether.

Table 3-2.
Cost Collection and Reporting Contract Clauses

FAR/DFARS reference	Clause title
252.234-7000	Notice of Cost/Schedule Control Systems
252.234-7001	Cost/Schedule Control Systems

Unfortunately, FASA does not address C/SCSC at all. Therefore, potentially extensive cost-collection and reporting requirements can still be imposed on subcontractors providing commercial items that will be incorporated into noncommercial end items that are considered major system acquisitions. As a result, this area must still be viewed as a potentially major barrier to obtaining commercial products from commercial companies. DoD may wish to petition the Administrator of OFPP to add these C/SCSC clauses to the list of inapplicable provisions regarding commercial items.

SOURCE RESTRICTIONS

Several clauses in the regulations (shown in Table 3-3) serve to restrict the origin of components, such as ICs, used in defense items. The Buy American Act is the primary statute that restricts the source of ICs used in defense items to those of domestic manufacture. To qualify as a domestic end product, a product must be mined or produced in the United States, and the cost of the U.S.-produced components must exceed half of the cost of all the product's components. While not prohibiting purchases of foreign products, the Buy American Act favors domestic products by requiring a cost differential to be added to foreign product offers. DFARS clause 252.225-7000 requires the prime contractor to list any components that are not of domestic manufacture and to certify that the item offered meets the domestic content requirement.

Table 3-3.
Source Restriction Contract Clauses

FAR/DFARS reference	Clause title
252.225-7000	Buy American Act — Balance of Payments Program Certificate
252.225-7001	Buy American Act and Balance of Payments Program
252.225-7006	Buy American Act — Trade Agreements Act — Balance of Payments Program Certificate
252.225-7007	Trade Agreements Act
52.225-1	Buy American Certificate
52.225-20	Buy American Act — North American Free Trade Agreement Implementation Act — Balance of Payments Program Certificate
52.225-21	Buy American Act — North American Free Trade Agreement Implementation Act — Balance of Payments Program

The requirements under the Buy American Act are imposed on the prime contractor, and the prime contractor is not specifically required to flow the requirements down to subcontractors. However, if the prime contractor must certify as to the domestic content of items, it must collect data on the origin of components. In some instances, the prime contractor may use a domestic source

to satisfy domestic content requirements even though that source is not the preferred one.

When DoD buys ICs directly, it generally chooses a domestic source. The impact of the Buy American Act is less clear when the IC is a component purchased from a subtier supplier as part of a larger system. If the IC is listed in the Buy American Act certification, then some administrative burden has been imposed on the subtier supplier. We have no information on the extent or size of the burden placed on subtier suppliers by the Buy American Act restrictions. However, we do know that commercial buyers of ICs do not require certification of the origin or domestic content of components.

The current trend is for U.S. companies to manufacture ICs offshore, and under the source restriction laws these firms may be excluded from defense business. MILSPECs now permit the purchase of ICs that have been packaged offshore, and DoD is considering relaxing the restriction even further and permitting purchase of ICs fabricated offshore. FASA, however, does not address source restrictions, and DoD's policies do not override the source-restriction statutes.

Under certain trade agreements, foreign-sourced items are counted as domestic for Buy American Act purposes. ICs, however, are among a number of goods to which those provisions do not apply. Also, the trade agreements do not currently cover the major Asian sources of commercial ICs. We recommend that the government add ICs to the list of goods covered by U.S. trade agreements, and that the government pursue trade agreements with countries that are major IC suppliers but are not currently covered.

DATA RIGHTS

Both the government and the contractor have legitimate interests in how rights to technical data are treated and in who owns technical data that may be generated, used, or delivered under a government contract. The government will need a certain amount of data regarding the components of its systems so that it can operate, repair, test, and support the equipment; train its personnel; and ensure a source of supply at competitive prices for replacement components (i.e., for "reprocurement") during the potential inventory life of the equipment.

Contractors may also have concerns about using design techniques or fabrication processes when those techniques have been developed at private expense but are applied to a military-unique product. Also, mixing funding for some components (i.e., part of the entire development cost is paid for by each party) can lead to potentially contentious ownership positions between the private contractor and the government. Government and industry have struggled for decades to find the best way to accommodate these competing needs and interests. The approaches to such accommodation have ranged from an insistence on unlimited rights by the government to virtual reliance on sole-source suppliers. Neither extreme has succeeded in satisfying the parties, and, as a result, some

commercial firms have adopted a policy of avoiding government contract business altogether rather than to take the risk of uncertain ownership of data.

DoD has recently adopted a new policy whereby it shall acquire only the technical data customarily provided to the public with a commercial item or process, even if the commercial product is embedded in a military-unique end item.[22] This policy should make it easier for traditional defense firms to use commercial ICs in their systems. Another barrier that has been removed is that subcontractors at all tiers have the same protection of their rights in data as is provided to prime contractors. Prime contractors may not require subcontractors or suppliers at any tier to relinquish data rights as a condition for award of any contract, subcontract, or purchase order.

Despite these changes, some data rights barriers remain. Several contract clauses (listed in Table 3-4) require data marking, record keeping, and deferred delivery to the government. These clauses call for procedures that are not found in commercial business dealings and can therefore operate as barriers to dealing with strictly commercial firms.

Table 3-4.
Data Rights Contract Clauses

FAR/DFARS reference	Clause title
252.227-7013	Rights in Technical Data — Noncommercial Items
252.227-7017	Identification and Assertion of Use, Release, or Disclosure Restrictions
252.227-7026	Deferred Delivery of Technical Data or Computer Software
252.227-7027	Deferred Ordering of Technical Data or Computer Software
252.227-7037	Validation of Restrictive Markings on Technical Data

To obtain the protections of private data rights that are now available, a firm must specifically mark technical data with restrictions on their use, modification, reproduction, release, or disclosure. Furthermore, the firm must identify in its bid to the government those data to be furnished with restrictions. COs have the right to review, verify, and challenge the markings. COs may not, however, challenge a contractor's assertion that a commercial item, component, or process was developed at private expense, unless the government can demonstrate that it contributed to the development (that is, the burden of proof is on the government).

In addition to special data markings, commercial component manufacturers must maintain records sufficient to justify the validity of the markings. The firms must be prepared to furnish to the CO a written justification for such restrictive markings. If a commercial IC firm is willing to comply with the marking and record-keeping requirements, DoD will have access to commercial IC

suppliers. Such marking and record-keeping systems are not, however, something that most truly commercial firms find necessary for their normal operations.

DoD requires companies to deliver technical data to the government up to two years after the last item is delivered under the contract. Considering the short life cycle of high-technology components, a company may have ceased production of that item years before the final delivery to the government and yet must not only retain, but also be able to deliver them, those technical data to the government.

In addition, a potentially significant unknown is lurking within the subject of intellectual property rights that has not been addressed in policy or regulation and is uniquely significant to the field of ICs. In 1984, Congress enacted the Semiconductor Chip Protection Act (17 U.S.C. 901, et seq.), which created an entirely new class of intellectual property (known as "mask works") distinct from either patents or copyrights.[2] In the years since the passage of this act, its precepts have not been implemented in the FAR nor has any policy guidance been issued to address how this entirely new kind of property should be handled in the context of government contracts. The subject of this law, semiconductor mask works, is at the heart of the IC business. Therefore, this silence has been interpreted to mean that semiconductor mask works will be handled in the same manner as technical data in government contracts, rather than as a separate class of property that has distinct rights, and that perhaps is treated differently. While this lack of guidance will not necessarily affect suppliers of truly commercial ICs, it can have a potentially devastating impact in situations where a supplier would design a "custom" chip for a defense program and then seek to introduce it into the commercial marketplace.

In this situation, ownership of the mask work is the issue. Since the mask work is treated like any other design, the government owns the rights. Consequently, the government could give the design away and thereby hurt the firm's position in the marketplace. To the extent that the custom design uses proprietary design or process techniques, the supplier may face compromise of critical competitive advantages. We recommend that implementing regulations be drafted for the Semiconductor Chip Protection Act. The regulations should permit the designing firm to retain all of the rights for commercial application.

SOCIOECONOMIC REQUIREMENTS

The government often seeks to use its status as a major buyer of goods and services to accomplish a variety of social and economic goals. This is done by requiring the recipients of government contracts or subcontracts undertake certain desired actions as a condition of receiving those contracts. Consequently,

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[2]Mask works are the master patterns that define how the electronic circuits will be formed on the semiconductor chip.

the defense dollar is expected to perform double duty: not only satisfying the primary purpose for which it was authorized but also contributing to these socioeconomic objectives. The specific topics addressed by these socioeconomic clauses (as shown in Table 3-5) are subcontracting with small and small disadvantaged businesses, treatment and hiring of disabled and Vietnam-era veterans and handicapped workers; and general equal employment opportunity and affirmative action matters.

Table 3-5.
Socioeconomic Contract Clauses

FAR/DFARS reference	Clause title
252.219-7003	Small Business and Small Disadvantaged Business Subcontracting Plan (DoD Contracts)
52.219-9	Small Business and Small Disadvantaged Business Subcontracting Plan
52.222-21	Certification of Nonsegregated Facilities
52.222-26	Equal Opportunity
52.222-35	Affirmative Action for Special Disabled and Vietnam Era Veterans
52.222-36	Affirmative Action for Handicapped Workers
52.222-37	Employment Reports on Special Disabled Veterans and Veterans of the Vietnam Era

While the requirements associated with small-business subcontracting become involved at contract and subcontract values of $500,000 and above, those associated with veterans become applicable at the $10,000 level and those for handicapped workers are applicable to contracts and subcontracts of more than $2,500. Clearly, a commercial firm does not have to have a significant amount of government business involvement before the costs, administrative burdens, oversight, and potential liabilities associated with these socioeconomic provisions present themselves.

Socioeconomic contract clauses impose both burdens and potential liabilities not found in commercial business dealings and are therefore a barrier to increasing the involvement of commercial firms in the Federal marketplace. The requirements called for by these clauses can

- hurt a commercial firm's established vendor relationships by restricting its freedom to choose suppliers;
- give rise to the need for special record keeping;
- mandate specialized report preparation; and
- require government audit of the records and reports.

Restricting a company's freedom to subcontract with its established vendors can increase the acquisition costs and schedules, as new vendors must be found and trained. Maintaining the personnel and procedures needed to prepare the reports, statistics, and administrative actions needed to ensure compliance adds to overhead costs. In addition to these costs, contractors face potential liability when their processes undergo audits for compliance. Although these socioeconomic laws were passed with the best of intentions, the cumulative effect has been to create significant barriers to commercial firms. As one contractor commented:

> [A] contractor's choices are limited to spreading these costs [of socioeconomic and regulatory legislation] over its commercial sales (and thus becoming less competitive commercially) or absorbing the costs out of profits. Neither choice provides an incentive to do business with the U.S. Government. As a result, each Government contract-unique requirement should be viewed as the potential cause of yet another U.S. commercial contractor deciding not to compete for the sale of its commercial products to the Government.[23]

The government enforces its socioeconomic provisions through contract clauses with mechanisms such as suspension and debarment to obtain compliance. Since most socioeconomic policy is intended to be implemented on a company-by-company, rather than contract-by-contract, basis, regulation through contract clauses is not only burdensome, but inconsistent with Congressional intent. To address this issue on one of the socioeconomic provisions, the proposed regulations that implement FASA suggest that an annual, companywide subcontracting plan be used for commercial firms in lieu of the contract-by-contract subcontracting plan currently required. Thus, although the barrier to preparing a subcontracting plan still exists, it is reduced. A similar approach could be taken for the other clauses.

The requirements of the Nonsegregated Facilities and Equal Opportunity clauses are considered the "law of the land" and are not really unique to government contracting. Every company must comply with the 1964 Civil Rights Act's equal employment opportunity (EEO) requirements, whether or not it does business with the Federal government. What is unique about the FAR clauses, however, is their reporting, record-keeping, and audit provisions. Although commercial companies must comply with the law and may keep certain records for that purpose, they are not required to establish compliance with the law by completing forms and allowing access to their records as a condition for entering into a commercial contract.

The government is seeking to take advantage of the products and services, pricing, competition, and technology advances that are available in the commercial marketplace. However, since the government's demand is a small fraction of the total demand for ICs, anything about its buying practices and terms and conditions of its contracts that makes it different than normal commercial customers can only work against achieving this objective.

FASA does not address socioeconomic requirements under its exemptions to statutory coverage allowed for the purchase of commercial items. All of the clauses involved arise from specific statutory requirements, so DoD may wish to

petition the Administrator of OFPP to add these clauses to the list of clauses not applicable to the purchase of commercial items at either a prime contract or subcontract level. Alternately, the buying agency may request a waiver from the Department of Labor.

PRECIOUS AND SPECIALTY METALS

The Defense Federal Acquisition Regulation Supplement (DFARS) clauses shown in Table 3-6 define precious and specialty metals. Silver, gold, platinum, iridium, rhodium, and ruthenium are precious metals. The definition of specialty metals is somewhat more complex. Specialty metals are defined as follows:

- steel, where the maximum alloy content is more than 1.65 percent manganese; 0.6 percent silicon; or 0.6 percent copper;
- steel that contains more than 0.25 percent of aluminum, cobalt, columbium, molybdenum, nickel, titanium, tunsgten, or vanadium;
- metal alloys consisting of nickel or iron-nickel and cobalt-based alloys;
- titanium and titanium alloys; and
- zirconium and zirconium alloys.

Both precious and specialty metals are used in the manufacture of ICs. According to the U.S. Census of Manufactures, material inputs to the semiconductor industry include gold and other precious metals, and the specialty metals alloy steel, stainless steel, and nickel alloys.[4]

Table 3-6.
Precious and Specialty Metals Contract Clauses

FAR/DFARS reference	Clause title
252.208-7000	Intent to Furnish Precious Metals as Government-Furnished Material
252.225-7014	Preference for Domestic Specialty Metals [including Alternate I]

The precious metals clause is used to implement the DoD policy contained in DoD Directive 4160.22, *Recovery and Utilization of Precious Metals*, and DoD 4160.21-M, *Defense Utilization and Disposal Manual*. This policy essentially amounts to a recycling process whereby DoD Components are required to recover precious metals from supplies. The recovered metals are managed by the

Defense Industrial Supply Center (DISC) and are provided to production contractors rather than using contractor-furnished precious metals when the CO determines it is in the government's best interest.

If the CO determines that precious metals are required, and that they are available from DISC, the clause is inserted into the solicitation. The contractor submits two prices – one including the cost of contractor-furnished metals and one without. The CO evaluates the cost of the government-furnished metal and makes the award on the basis of best interest to the government.

On the surface, this appears to be a good program, in that precious metals are recovered and reused. The government saves the cost of paying for these metals, assuming the government valuation of these metals is accurate, and reflects the cost of recovery and inventory holding costs. The program does, however, impose on the contractor the burden of tracking, managing, and reporting on the government-furnished material.

The specialty metal clauses implement public law (codified as a note to 10 U.S.C. 2241). The alternate clause differs from the basic clause in that it requires the clause to be flowed down to subcontractors when the acquisition involves aircraft, missile/space systems, ships, tank-automotive, weapons, or ammunition. Obviously, many of these systems contain abundant numbers of ICs.

Neither clause applies below the simplified acquisition threshold. FASA does not address any of these clauses directly, and the only effect it has had on this area is to raise the simplified acquisition threshold from $25,000 to $100,000, which will mean that some procurements that formerly had to include the relevant clause now will not have to do so. Nevertheless, in the case of commercial semiconductors, the business and technical decisions made regarding the use of exotic metals and alloys are driven by economic and scientific considerations, and the government's imposing additional record-keeping or source-selection restrictions can only be viewed as an unnecessary intrusion into commercial matters best left to the firms involved in the commercial marketplace.

SUMMARY

The recent acquisition reform has clearly reduced the barriers to commercial firms and to DoD's using commercial products, but significant aspects of the government contract environment remain that can inhibit the use of a commercial firms' products. In the case of ICs, in particular, the relatively small and diminishing size of the defense market and the fact that a substantial portion of commercial IC manufacturing is done outside the United States both serve to make the contractually based barriers a special problem for initiatives for broadening the use of commercial ICs in military systems. In the aftermath of FASA, many of the unique government contract provisions and clauses that remain applicable to either prime contracts or subcontracts tend to carry with them both non-value-added administrative costs and potential civil or criminal liabilities

that would never be encountered by a commercial firm in its normal business dealings. Exemptions or waivers from many of these clauses will require

- DoD petitioning the Administrator of OFPP to get these provisions and clauses added to the list of those not applicable to commercial item contracts or subcontracts,
- special legislative action, or
- waiver by an agency head who has the authority to do so.[3]

Until acquisition reform succeeds in allowing the government easily and regularly to access the full population of commercial firms, it will not have had the truly significant impact needed to make commercial IC use the norm rather than the exception. To do this will require an approach that defines "commercial" by giving at least as much weight to the primary marketplace in which the supplier does business as it does to the nature of the particular item being bought. This approach would provide the necessary flexibility to deal with the following circumstances: the item being bought is, in fact, custom-designed and not commercial; however, the firm best suited to do the work operates primarily in the commercial marketplace and, without substantial changes in the government's normal approach to contracting with its suppliers, is unwilling or unlikely to want to seek opportunities for business on government programs. For this reason, the extent of flowdown required for many of the special clauses remains a subject of continuing interest.

As significant as the changes brought about by FASA are, the government still needs to take special and focused steps to bring these changes to the attention of commercial firms. Many commercial firms may not regularly review the *Federal Register* or the *Commerce Business Daily*, because they have not sought to do business with the government or had previously explored such a market and were dissuaded by the contract environment. Therefore, the normal forms of announcements used to bring attention to contracting changes and opportunities are not likely to reach the intended commercial firms.

To get the word out to these firms that the government marketplace is not now as foreboding as it was in the past, new and broader information dissemination is needed. FASA requires agencies to conduct market research to identify commercial sources to meet the government's needs, and using the *Commerce Business Daily* will not yield new commercial firms. Consequently, new methods need to be employed to interest truly commercial firms to enter into the government contract environment. Such outreach may also provide the government with valuable insights in support of its growing need for information about commercial firms and commercial product availability.

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[3]An "agency head" means the Secretary of Defense (SECDEF) or one of the Service Secretaries. Subject to the direction of the SECDEF, the Undersecretary of Defense (Acquisition), the Director of Defense Procurement, and the directors of Defense agencies may also grant waivers.

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[10] Marc W. Crooks, *Application of Image Compression to Digital Map Databases*, U.S. Army Missile Command Technical Report RD-GC-93-16, Redstone Arsenal, Huntsville, Ala., February 1993.

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APPENDIX A

Reports Recommending Actions for Inserting Commercial Integrated Circuits into Military Systems

This appendix provides summary recommendations to DoD from the major reports dealing with microelectronics, commercial-item insertion, and acquisition reform. The starting point for our literature search was the 1986 Defense Science Board (DSB) study. The first two pages provide a chronological legend for abbreviations used in the listing.

Shorthand	Citation
86-DSB	Department of Defense. *Use of Commercial Components in Military Equipment.* Final Report of the Defense Science Board 1986 Summer Study. January 1987.
88-Costello	Department of Defense. *Enhancing Defense Standardization. Specifications and Standards: Cornerstones of Quality.* Report to the Secretary of Defense by the Under Secretary of Defense (Acquisition). November 1988.
89-DSB	Department of Defense. *Report of the Defense Science Board on Use of Commercial Components in Military Equipment.* June 1989.
92-IG	Department of Defense. *Acquisition Streamlining: Specifications and Standards.* Inspector General Inspection Report 92-INS-12. 21 September 1992.
93-Carnegie	The Carnegie Commission on Science, Technology, and Government. *New Thinking and American Defense Technology.* Second Edition, May 1993.
93-DESC	Department of Defense. *Commercialization Status Report and Progress Report on Implementing the Defense Science Board Recommendations [on] Microelectronics.* DoD Microcircuit Planning Group. October 1993.
93-DSB	Department of Defense. *Report of the Defense Science Board Task Force on Defense Manufacturing Enterprise Strategy, 1993 Summer Study.* September 1993.
93-IDA	Kanter, Hershel, and Richard H. Van Atta. *Integrating Defense into the Civilian Technology and Industrial Base.* Institute for Defense Analyses Paper P-2801. Alexandria, Va., February 1993.
93-Sect 800	Department of Defense. *Streamlining Defense Acquisition Laws. Executive Summary: Report of the DoD Acquisition Law Advisory Panel.* March 1993.
93-SIA	Semiconductor Industry Association. *SIA GPC White Paper on Government Procurement Issues.* May 1993.

Shorthand	Citation
94-AF	Department of Defense. *Report of the Commercial Acquisition Streamlining Team for the Microelectronics Industry*. Office of the Assistant Secretary of the Air Force (Acquisition). April 1994.
94-IRP	Department of Defense. *Report of the Industry Review Panel on Specifications and Standards*. 18 February 1994.
94-PAT	Department of Defense. *Report of the Process Action Team on Military Specifications and Standards: Blueprint for Change*. April 1994.
94-SIA	Semiconductor Industry Association. *SIA Update: GPC White Paper on Government Procurement Issues*. May 1994.

Many recommendations addressed by these reports refer to MILSPECs. While the term MILSPEC is, strictly speaking, an abbreviation for "military specification," DoD commonly uses this term more broadly, as we do in this list, to include military standards, which establish uniform criteria, methods, processes, and practices for developing military-unique applications; military handbooks; military bulletins; DoD standards; NATO standards; and any other document listed in the DoD Index of Standards and Specifications (DoDISS).

Recommendation	Source/Pg.
I. Technical Management, Standards, and Specifications	
A. Weapon System Requirements	
- Change the requirements process to focus on a needs description, with a requirement to consider commercial products.	86-DSB 39
- Require equipment developers to identify the minimum IC component class to match operational and environmental use requirements.	86-DSB 24
- Re-orient the weapons systems requirements process to emphasize producibility and reconstitution.	93-IDA V-2
- Define requirements so that commercial and other nondevelopmental items may be procured to fulfill those requirements.	93-Sect800
- Encourage program offices and their contractors to challenge performance requirements and to understand cost/performance trade-offs using simulation, design-to-cost, and Cooperative Research and Development Agreements.	94-PAT 131
B. Performance-Based Specifications	
- Replace MILSPECs with nongovernment standards or commercial item descriptions.	86-DSB 41
- Simplify the adoption process for nongovernmental specifications.	88-Costello
- Reduce technical data requirements by making use of performance specifications rather than building to print.	93-DSB
- Eliminate prescriptive requirements: manufacturing management, producibility, quality, reliability, software engineering, subcontract management, systems engineering, safety systems, value engineering, and work measurement.	93-IDA III-25, 26
- Use performance rather than process (how-to) specifications. Expand tailoring of MILSPECs.	94-AF 41
- All major programs should state needs in terms of performance specifications and use commercial item descriptions, nongovernment standards, or performance-based MILSPECs.	94-PAT 18, 22
- Direct that manufacturing and management standards be canceled or converted to performance or nongovernmental standards. Allow contractors to meet the intent of cited standards. (Report lists 52 standards including MIL-STD-454, MIL-STD-883, and MIL-M-38510.)	94-PAT 31

Recommendation	Source/Pg.
- Prohibit use of MILSPECs. Exempt for performance-based specifications, military-unique documents, cases in which no acceptable alternative exists, or cases in which the alternative is not cost effective.	94-PAT 43
C. Tailoring of Specifications	
- Use fill-in-the-blank specifications.	86-DSB 40
D. Tiering and Referencing in Specifications	
- Eliminate tiering of specifications and standards.	94-IRP 18
- Eliminate hidden requirements imposed through references (tiering) in specifications or on military drawings.	94-PAT 43, 63
- Ensure that MILSPECs list only those references essential to establishing technical requirements.	94-PAT 55
E. Parts Control and Configuration Management	
- Streamline the military drawing system to standardize interfaces, control part numbers, and obtain production efficiencies.	86-DSB 24, 74
- Before buying commercial products, require analysis for logistics, e.g., configuration control, interoperability, maintenance, and training.	86-DSB 50
- Replace source control drawings with standard microcircuit drawings and rugged industrial ICs as appropriate.	89-DSB A-17
- Retain and promote the Standard Microcircuit Drawing program.	93-SIA 11, 13
- Change MIL-STD-973 (Configuration Management) to recognize MIL-STD-983 (Substitution Standard for Microelectronics) as a substitution list.	94-AF 26
- Have a one-time approval for a contractor's parts control system instead of for each contract.	94-AF 32
- Develop agreements among program offices to allow nonstandard parts approved by one to be accepted by another.	94-AF 36
- Modify MIL-STD-973 (Configuration Management) and DI-EGDS-80811 (VHSIC Hardware Description Language) to require configuration control only to the circuit board level and require that cards be electronically documented.	94-AF 21

Recommendation	Source/Pg.
- Include MIL-STD-983 (Substitution Standard for Microelectronics) in every statement of work.	94-AF 26
- Develop a standard government/industry system for technical audits. Allow contractors to use QML validations to eliminate redundant audits.	94-AF 40
- Eliminate duplicate national stock numbers among microcircuits.	94-AF 34
- Revise MIL-STD-965 (Parts Control Program) to permit contractors to use new technology parts not currently reflected in the government furnished baseline.	94-AF 31
- Encourage the use of standard microcircuit drawings instead of source control drawings to prevent the creation of multiple national stock numbers.	94-AF 33
- Revise DoDI 5000.2 (Defense Acquisition Management Policies and Procedures) to state that the government should maintain configuration control of the functional and performance requirements only, giving contractors control of design. The government may assume control of allocated and product baselines after functional configuration audit.	94-PAT 25
- Maintain MILSPECs requiring vendor notification of design changes (this is necessary for military technical and logistic support; no commercial equivalent exists).	94-SIA 11, 12
F. Order of Precedence in Selecting ICs	
- Modify MIL-STD-454 to make Joint Army-Navy devices and military drawing devices of equal precedence, with MIL-STD-883C devices a slightly lower precedence.	86-DSB 25, 76
G. Assuring Quality and Reliability	
- Certify and audit IC suppliers and processes.	86-DSB 25
- Use ICs from QML lines as a first preference.	89-DSB A-18
- Fully implement the QML and SMD programs.	89-DSB vii
- Certify the semiconductor design and manufacturing process, not individual ICs.	89-DSB A-17
- Adopt ISO 9000 (Quality Management and Quality Assurance Standards).	93-DSB

Recommendation	Source/Pg.
- Retain and promote the QML program.	93-SIA 10
- Keep MIL-STD-883 (Test Methods . . .) as the test and screening standard because QML is not suited to operating methods of smaller or specialty IC makers.	93-SIA 13
- Remove the requirement from MIL-I-38535 (Integrated Circuits . . .) for onshore wafer fabrication.	94-AF 24
- Eliminate the blanket shelf-life requirement to automatically retest/scrap parts based on storage time. Have proper flowdown of MIL-STD-1546 (Parts, Materials, and Processes Control Program for Space and Launch Vehicles) that allows subcontractor to specify shelf life.	94-AF 36, 37
- Allow contractors to use ISO 9000 (Quality Management and Quality Assurance Standards) instead of MIL-Q-9858 (Quality Program Requirements).	94-AF 44
- Eliminate the practice of automatic rescreening by IC users.	94-AF 30, 31
- Promote and expand the QML approach.	94-AF 19
- Require that MIL-I-38535 (Integrated Circuits . . .) be included in the statement of work for all systems that include microcircuits.	94-AF 19
- Replace military standards for test, inspection, and quality assurance (e.g., MIL-Q-9858) with process control and nongovernmental standards (e.g., ISO 9000 series). Change DFARS 246 (Quality Assurance).	94-PAT 95, 100
- Revise MIL-STD-490 (Specification Practices) and MIL-STD-961(. . . Defense Specifications): contractors should certify to the government that items offered for acceptance satisfy the requirements of the specifications through process controls and inspections. The government may witness such contractor process controls or inspections.	94-PAT 26
- Make distinctions between MILSPECs that apply directly to the manufacture and test of ICs and those that set requirements for quality control systems. Commercial equivalents of the former do not exist; commercial equivalents of the latter do.	94-SIA 1
- Replace MIL-Q-9858 (Quality Program Requirements) with ISO 9000 (Quality Management and Quality Assurance Standards) or an equivalent that relieves contractors of having to host repeated government audits.	94-SIA 13

H. IC Characterization Data and Applications Guides

Recommendation	Source/Pg.
- Develop an IC reliability database and vendor feedback system.	86-DSB 24
- Develop a semiconductor application guidebook.	86-DSB 24
- Specify environments where industrial plastic- encapsulated ICs may be used.	86-DSB 25
- Develop, with industry, common electronic component specifications. Use the plastic industrial-grade IC specification as the prototype.	89-DSB vii
- Implement a field failure return program.	89-DSB A-18
- Establish a field-failure database.	93-DESC
- Substitute MIL-HDBK-179 for the precedence requirements of MIL-STD-454, Requirement 64.	93-DESC
- Focus R&D on applying advanced commercial technology to defense systems.	93-IDA V-4
- Recommend caution when applying commercial grade plastic ICs in military systems. Plastic ICs, while acceptable in benign or protected environments, are not as reliable in high moisture conditions.	93-SIA 13
- The military IC application handbook should better define the relationship between operating environments and classes of product.	93-SIA 14
- Promote programs to improve the reliability of plastic ICs.	93-SIA 14
- Expand MIL-HDBK-179 (Microcircuit Application Handbook) to include Air Force requirements.	94-AF 28
- Establish a consensus definition of commercial ICs and define a range of applications and environments for which these devices are suitable.	94-SIA 1
I. Management (Specifications and Standards)	
- Strengthen defense standardization management.	86-DSB 41
- Evaluate the lead standardization acitvities for appropriateness and reassign when necessary.	88-Costello

Recommendation	Source/Pg.
- Designate an office and a standardization executive as having authority to mandate compliance with standardization policies.	88-Costello
- Designate a single military department or agency to program and budget funds for the standardization program.	88-Costello
- Designate a single OSD person as responsible for semiconductor activities. Designate the organization responsible for implementing semiconductor design and process certification.	89-DSB vii
- Do not eliminate MILSPECs until commercial substitutes are defined.	93-SIA 17
- Establish the authority and responsibility of the Standards Improvement Executives and provide them with adequate resources.	94-PAT 161
- Assign responsibility for preparing standards for the Federal Supply Classes that are primarily commercial to the Defense Logistics Agency.	94-PAT 89
- For military systems which have requirements less stringent than those required by current MILSPECs, modify the MILSPECs rather than abolish the MILSPEC system.	94-SIA 10
J. Preparation and Maintenance (Specifications and Standards)	
- Establish regular meetings with major industry associations about standards and provide a directory of DoD people within the standardization community.	88-Costello
- Reformat the DoDISS and review it for accuracy.	88-Costello
- Have Military Departments and agencies review each document for which they are responsible and update, cancel, or change the document to a commercial item description.	88-Costello
- Establish procedures to control the proliferation of non-DoDISS documents.	92-IG
- For the short term, eliminate or modify the top 10 cost-driver MILSPECs, including MIL-STD-454.	94-IRP 18
- Reduce the DoD's administration time for approving industry-equivalent MILSPECs.	94-IRP 18
- For the long term, review and eliminate other MILSPECs where warranted. Cancel or convert to handbooks or commercial documents all MILSPECs of a non-product nature (management and process documents).	94-IRP 18

Recommendation	Source/Pg.
- Encourage industry to develop commercial standards that replace military standards.	94-PAT 75
- Include industry and government users in the development of MILSPECs.	94-PAT 75
K. Training (Specifications and Standards)	
- Program managers and commodity managers must be better trained regarding the benefits of commercial products and how to use them.	86-DSB 55
- Have the Defense Systems Management College develop additional courses for standardization training.	88-Costello
- Ensure acqusition personnel receive adequate training on limitations on using non-DoDISS documents.	92-IG
- Ensure that program managers are educated in acquisition streamlining and specification tailoring.	92-IG
- Train government personnel in MILSPEC reform. Invite contractor participation.	94-PAT 145
L. Automation (Specifications and Standards)	
- Automate MILSPEC development, update, and delivery.	86-DSB 41
- Automate the Defense Standardization Program.	88-Costello
- Develop an automated MILSPEC system.	92-IG
- Automate development and dissemination of MILSPECs.	94-PAT 121
Other	
- Shift to greater use of standard or commercial interface specifications to allow for product upgrades.	86-DSB 53
- Consider the impact of relying on offshore manufacturing.	89-DSB A-18
- Clarify use of non-DoDISS documents in acquisitions.	92-IG

Recommendation	Source/Pg.
- Use MILSPECs on an exception basis. The National Institute of Standards and Technology should take the lead in establishing dual military-industry standards.	93-Carnegie
- Remove conflicting language from MIL-STD-1285 (Marking of Electrical and Electronic Parts) on electro-static discharge marking and use commercial marking practices.	94-AF 38
- Review Data Item Descriptions in DoD 5010.12-L and eliminate those that are duplicative, unnecessary, obsolete, or not cost effective.	94-PAT 69
- Identify and reduce pollutants procured or generated through the use of MILSPECs.	94-PAT 137
II. Acquisition Process and Practices	
A. Legislative and Regulatory Changes to Encourage Commercial Practices	
- Establish a series of pilot programs to demonstrate the use of commercial practices and validate the benefits to DoD.	86-DSB 57
- Develop a pilot program to demonstrate commercial buying practices. Include training in commercial contracting. Trust the contracting officer to get the best value, and modify the protest system.	89-DSB v, 10
- Establish procurement regulations that give precedence to commercial products when they are available.	93-Carnegie
- Adopt the Uniform Commercial Code for acquiring commercial items.	93-Carnegie
- Allow audits to be performed by commercial accounting firms.	93-DSB
- Insert a new definition of commercial items in 10 U.S.C. 2302 (defense procurement definitions).	93-Sect800
- Make 10 U.S.C. 2313 (Examination of books and records) inapplicable to commercial items.	93-Sect800
- Insert stronger language favoring use of commercial items in 10 U.S.C. 2301 (Congressional defense procurement policy).	93-Sect800
- Issue rules that would provide for shortened time periods for submission of bids for commercial items.	93-Sect800
- Permit existing prime contracts to be modified to include the Section 800 panel's definition of commercial item subcontracting.	93-SIA 4

Recommendation	Source/Pg.
B. Incentives for Inserting Commercial Products and Practices	
- Develop a series of contractual incentives to motivate the expanded use of commercial products and practices, e.g., source selection criteria and award-fee pools.	86-DSB 45
- Have program managers develop incentives for potential primes to use commercial products in their bids.	86-DSB 55
- Devise incentives for contractors to search for efficiencies and savings.	93-DSB
- Require all new high-value solicitations and ongoing contracts to have a statement encouraging contractors to submit alternatives to MILSPECs. Use the no-cost settlement method to implement this.	94-PAT 43
- Offer profit or award-fee incentives for viable alternatives to military specifications. Amend DFARS 215.971 (Weighted Guidlines Incentive).	94-PAT 45, H-27
- Allow program offices to keep a portion of the savings realized by MILSPEC reform, and to allocate it consistent with appropriation and obligational constraints.	94-PAT 160
C. Cost or Pricing Data	
- Permit contracting officers to exempt commercial suppliers from cost or pricing data requirements.	89-DSB 11, A-60
- Clarify the exception for adequate price competition to include comparisons to similar items or to items using similar production processes.	93-Sect800
- Add an exception to requirements for submission of cost and pricing data over the threshhold for modifications to commercial items if the modification does not change the item to a noncommercial item.	93-Sect800
- Expand the exemption for adequate price competition in the Truth in Negotiations Act and provide relief from the requirements for cost and pricing data when a commercial item is modified.	93-Sect800
- Maintain the threshhold for cost and pricing data at $500,000.	93-Sect800
- In addition to permanent increase in the Truth in Negotiations Act threshold to $500,000, recommend an increase to $1 million for trial period of three years.	93-SIA 4
- Eliminate Standard Form 1411 for data supporting price reasonableness. Permit formats consistent with contractor's accounting system.	94-AF 48, 52

Recommendation	Source/Pg.
- Raise the threshold for requiring cost or pricing data to $1 million.	94-AF 47
- Permit contractors to apply the same pricing regulations to intradivisional transfers as those that apply to outside subcontractors.	94-AF 70
- Waive the requirement for submitting cost or pricing data for microelectronics as a class. (An agency head may waive the cost and pricing data requirement, per FAR 15.804-3(i).)	94-AF 48
D. Source Restrictions	
- Repeal many of the source restrictions currently in authorization and appropriation acts.	93-Sect800
- Develop a new structure for Buy American restrictions: reconcile the definition for determining origin of a good between the Buy American Act and the Trade Agreements Act.	93-Sect800 –
E. Technical Data Rights	
- Protect the patent and data rights of contractors.	86-DSB 47
- Limit the government's access to proprietary technical data as permitted by 10 USC 2305(d)(4) (contract procedures). The government should retain rights if the supplier discontinues the item or goes out of business.	89-DSB 16, A-18
- Allow contractors to retain technical data rights where practical.	93-IDA III-33
- Add new exemptions to technical data requirements in commercial-item acquisitions.	93-Sect800
- Allow employees or former employees to assist in commercializing technologies they have developed.	93-Sect800
- Outline a new approach to technical data that focuses on the government's need to ensure reasonable life-cycle costs for spare parts and follow-on purchases.	93-Sect800
- Make minimal modifications to the technical data statute but enough to provide SECDEF more flexibility to explore other ways of handling the issue.	93-Sect800
F. Training (Acquisition)	
- Educate government buyers in commercial price analysis.	94-AF 54

Recommendation	Source/Pg.
Other	
- Establish bid lists of selected competent sources, based on criteria such as financial capability, personnel, facilities, and past performance.	86-DSB 45
- Base terms and conditions on the Uniform Commercial Code, expanded to account for administrative and product-support requirements.	86-DSB 47
- Modify the Competition in Contracting Act's protest procedures: file with the contracting officer before filing with the General Accounting Office, and modify the "stay provision."	86-DSB 47
- Direct buying commands to develop procedures to comply with the DFARS streamlining clause.	92-IG
- Establish a new office for making changes in response to the contractor submissions on problem documents.	92-IG
- Require contractors to submit a report that identifies duplicative contract deliverables, clauses, waivers, and deviations.	92-IG
- Eliminate DoD regulations duplicating laws for interstate commerce, e.g., discrimination, health, and workplace safety.	93-IDA III-32
- Minimize government-unique cost accounting and audit requirements.	93-IDA V-3
- Eliminate the "right" of any potentially qualified bidder to bid, and remove the DoD's obligation to ensure that all such bidders are aware of a DoD request.	93-IDA V-3
- Allow "determinations and decisions" to be made for a class of purchases or contracts.	93-Sect800
- Implement annual contractor submission of representations and certifications rather than submission on each contract; currently authorized under FAR 14.213 but DoD lacks the systems to administer it.	94-AF 58
- Use "partnering," informal and voluntary relationships between the Government and its contractors, to resolve program problems before they reach litigation.	94-PAT 179

APPENDIX B

Military Specifications and Standards Reform

BACKGROUND

In conducting interviews and collecting data on government barriers to the use of commercial integrated circuits (ICs), we encountered a number of program managers and engineers who were concerned about the course of military specification and standard (MILSPEC)[1] reform. While these people welcomed the opportunity to take advantage of commercial standards and products, they indicated that reform was forcing them to abandon MILSPECs that assured them of quality or program control, even when a commercial substitute was not available. With these preliminary indications, and using ICs (and their related standards) as an example, we set about to understand the background of MILSPEC reform, how it was being implemented, and what might be done to improve it.

The goals of DoD's MILSPEC reform are to reduce the acquisition and ownership cost of military equipment and to get better access to new technology while maintaining adequate quality. Reducing the burden of unnecessary or obsolete government standardization and documentation and encouraging more firms to compete for military contracts are the means to achieving those goals. The fundamental premise is that, for many MILSPECs, the benefits do not justify the costs. This may be so, and a program to address the issue is certainly warranted. Our experience with ICs indicates that MILSPECs should be reformed, but such reform should be integrated and coordinated, with both the costs and the benefits considered.

We believe that the reform process, while needed, has been overzealously implemented. However, that initial overzealousness is showing signs of being tempered, and a more rational approach is emerging. Nonetheless, how MILSPEC reform is implemented varies considerably and can be improved significantly. The observations that led us to this opinion are presented in this appendix. Assessing acquisition-reform implementation as it relates to MILSPECs requires understanding the use and importance of standards, the acquisition environment, and the actions leading to the reform of MILSPECs. The following subsections cover these fundamentals.

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[1]While the term MILSPEC is, strictly speaking, an abbreviation for "military specification," DoD commonly uses this term more broadly, as we do here, to include military standards, military handbooks, military bulletins, DoD standards, NATO standards, and any other document listed in the DoD Index of Standards and Specifications (DoDISS).

Importance of Standards

Standards are essential to society. Standards include those we normally recognize, such as weights, measures, and time, plus many we take for granted, such as spelling, alphabets, accounting methods, traffic signs, parliamentary procedure, and law. Standards are never permanent, even though many, such as the 7-day week and the 60-minute hour, are remarkably long-lived and stable. Competition also exists in setting standards (e.g., Beta and VHS for home video devices), which can result in multiple standards coexisting for extended periods of time.

Standards exist to serve different functions such as technical performance, cost reduction, management, and manufacturing. Standards have gained widespread acceptance for use in industry and the military as they establish a common baseline from which performance can be measured.

Overview of Military Specifications and Standards

The military developments that took place during World War II constituted a major breakthrough in warfare technology. Along with advances in technology came corresponding learning on how to manage procurements for the manufacture of military equipment. MILSPECs were born from the lessons learned in this period. Military standards establish uniform criteria, methods, processes, and practices for developing military-unique applications. Military specifications document requirements for use in development of military-unique hardware.

Unique specifications for new military equipment are often necessary because military equipment has pushed technology far beyond that of its commercial counterparts. The military has consistently been the first to exploit many new technologies and incorporate them into standard practice. Commercial implementations typically follow that are based on lower technology, with specifications that are derived from the military system but are less stringent. Where a strong market exists, as with computers, the resources of the market can accelerate the commercial technology beyond that of the military, but these cases are rare. If the military continues to push the state of the art, it must also continue to develop and apply new specifications for performance.

Specifications for military equipment are also necessary to provide support for long periods of time. The average age of the aircraft in the Air Force active, guard, and reserve units provides an example of the times involved. As data from *Air Force Magazine* and *USAF Almanac 1995* indicate, those ages are 17.7 years, 15.1 years, and 18.1 years, respectively. For the total fleet of 6,816 aircraft, the average age for major types of aircraft ranges from 1.2 years for the new C-17 to 33.5 years for the 607 KC-135s. Few commercial equivalents of the

KC-135 (Boeing 707) remain in the commercial fleet. Procuring detailed, standardized technical-data packages is one way to ensure that parts can be provided for older systems when original manufacturers no longer can provide support.

TECHNICAL STANDARDS AND SPECIFICATIONS

Technical standards and specifications are designs and manufacturing processes that are accepted by an industry or imposed by a buyer on its suppliers. Establishing technical standards can help control the cost of a product as well as ensuring its performance. One commercial example is the sealed-beam headlight. A complete halogen sealed-beam headlight, including bulb and lens, costs $11. By comparison, the headlight lens for a model- and year-unique Ford Taurus costs $95. The bulb costs an additional $11. People will pay the extra cost because of their taste in styling, rather than the cost-effectiveness of the product. Technical standardization has proved cost-effective for other products such as batteries, nuts and bolts, electrical fixtures, and railroad gauges.

Technical standardization involves a tradeoff between the performance and cost of an optimized design and the savings of using standard designs and components. The use of standard designs and parts can result in suboptimum design. When a design is suboptimum, it is so usually in terms of weight and volume but can also be so in terms of performance in cases where the standardized components have fallen behind the state of the art. Standard parts can also cost more when they are of higher quality than is necessary. For example, in a benign environment, using an IC that meets the standard full-temperature MILSPEC qualification is more expensive than using a consumer-grade plastic-encapsulated IC.

However, offsetting savings can accrue from the use of standard designs and parts because

- the performance of parts made from the standardized designs is known, since they can be bought "off the shelf" and therefore generally are widely used in a variety of commercial and consumer applications;
- configuration standards are maintained by a third party, at generally no direct cost to either the manufacturer or the customer;
- when acceptable production methods are established, production risk is low; and
- competitive sources are available or can be developed for replacement parts.

MANAGEMENT STANDARDS

Government employees are responsible for planning, programming, budgeting, and executing the defense program. The data and reports generated because of management standards are among the tools available to perform those tasks. Management standards that are targeted in the discussions of standardization reform include accounting standards, and cost-reporting, engineering-management, and program-reporting standards. In general, the standards allow both current and long-term comparisons of program data and also reduce the training necessary for government managers, accountants, and engineers.

Common government accounting standards are established to allow comparisons across Services and programs for budgeting and planning. As with technical standards, however, management standards can fall behind technology. New modes of data recording and transmission, new computational capability, and new cost accounts can all serve to make a standard accounting system obsolete.

Cost-reporting standards are established for both day-to-day program management and for collecting data over time. Detailed, standardized data on cost and overhead for cost and incentive-fee contracts are needed for two reasons: to determine whether bid differences from competing bidders result from technical differences or from overhead, and to support negotiations. Note that cost and incentive-fee contracts are typically applied to developmental items carrying significant technical risk and not to commericial items with market experience.

Engineering-management standards have been developed to ensure that issues such as logistics supportability, safety, training, and human factors are addressed in the design of military equipment. These standards often require similar information in different formats because they are sponsored by different groups with similar interests within the acquisition community. Consolidation of engineering management standards is a logical goal, providing that key issues continue to be addressed.

Program management standards, including technical and program reviews, and cost and performance reporting, have been developed to provide the government with the data deemed necessary to manage program risk. The data are used at the program office level to manage the risk of the individual program. They are also used at higher levels of the bureaucracy to manage higher levels of risk in the defense program.

For commercial items, other sources are available, such as market research, by which government managers can protect the government's interests. For military-unique items, however, elimination of management standards places a large burden on government contract managers. They become responsible for learning a contractor's internal procedures and determining how to use this information to monitor contract performance.

MILSPEC Reform in Theory and Practice

In general, we found that the basis for MILSPEC reform is sound; however in practice, the implementors sometimes ignore the benefits associated with certain MILSPECs. In examining the implementation of the reform at the OSD, Service, and program office levels, we found that the initial overzealous reaction to reform is evolving into a more rational approach.

MILSPEC Reform in Theory

The Perry Memorandum and Supporting Studies

While specification reform has been underway for many years with programs such as Air Force MIL-PRIME, it received new and dramatic impetus in 1994. In April 1994, DoD published the results of a process action team (PAT) review of military specifications and standards in the *Report of the Process Action Team on Military Specifications and Standards: Blueprint for Change.*

On 29 June 1994, Secretary of Defense William J. Perry signed a memorandum implementing the PAT recommendations and directing specific actions by the military services.[1] Spanning this period, from March through October 1994, Coopers and Lybrand, together with TASC, conducted a quantitative assessment of the costs of government regulations (including MILSPECs) for Secretary Perry.[2]

Secretary Perry's memorandum directs several major changes in the DoD acquisition process. In summary, the memorandum mandates that, following an adjustment period of 180 days, MILSPECs be eliminated except where absolutely unavoidable. The memorandum directs use of "performance specifications" for all new procurements, with preference for commercially developed, nongovernmental standards (NGSs) wherever possible.

In the management area, the memorandum directs program managers to "use management and manufacturing specifications and standards for guidance only," with the ultimate intent of eliminating them, or replace them with commercial specifications and standards. Contractors are to be given responsibility for the configuration control of detailed designs, with the government maintaining configuration control of functional and performance requirements only.

The Perry memorandum directs OSD, the Military Services, and the Defense Logistics Agency to appoint standards improvement executives to participate on a Defense Standards Improvement Council. The council has executive coordinating responsibility for the implementation program and reports to the Assistant Secretary of Defense (Economic Security). The Council coordinates its activities with the Deputy Under Secretary of Defense (Acquisition Reform) and the Acquisition Reform Steering Group.

BENEFITS OF MILSPECS NOT ADDRESSED

The aforementioned efforts generally give little consideration to the *benefits* of MILSPECs and the technical environment of military procurement. The specification reform program has been justified on the basis of MILSPEC cost alone. The Coopers and Lybrand/TASC study, for example, explicitly ignores any benefits of MILSPECs. It states

> . . . some claim that DOD receives substantial benefits from its regulatory activities. The Project Team did not attempt to validate the existence of such benefits or quantify their value. In other words, we looked only at the "cost" portion of the cost benefit ratio.

Demonstrating that a standard is "non-value-added" is easy if its benefits are ignored. Any valid assessment of standards and specifications must consider both the benefits and the costs.

While the MILSPEC system is undoubtedly in need of reform, not all MILSPECs are bad. The documents defining the Qualified Manufacturers List Program and the Standard Microcircuit Drawing Program are technical MILSPECs that save the government money in the procurement of ICs. Similarly, the contention that *all* management MILSPECs should be eliminated is based on the belief that regulations are the sole root cause of the problems and, consequently, that reform can solve the problems. Other factors also contribute to the high costs of weapon systems, and, in fact, many of the management regulations and standards are tools to keep those causes under control.

OSD Implementation of MILSPEC Reform

The Defense Standardization Office has established a team to review all MILSPECS with the goal of replacing them with appropriate industrial standards, reclassifying them, or canceling them. Called SWAT (which stands for Standards We Attack Tenaciously), this team has assigned the most frequently criticized MILSPECs to various DoD groups for review. The SWAT team's immediate goal is a preliminary review, with recommendations, on *all* MILSPECs by the end of FY95. Its target is to eliminate as many MILSPECs as possible.

Defense has issued a policy on the elimination of MILSPECs. This policy covers the documents themselves, not their application in requests for proposals (RFPs) and contracts. That application is being governed by the Services and is discussed in the following subsection. The Defense policy is as follows:

> Military specifications and standards are only being canceled after review to determine that they are no longer needed. Where conscious decisions have been made that documents are still needed, they are being replaced by a variety of new constructs:
>
> - Performance specifications that describe products in performance terms;
>
> - Detail specifications that describe products using both performance and design detail where it has been determined that the design detail is essential to achieving defense specific capability;

- Non-government standards (both performance and design) that describe products, test methods, practices, etc. in ways which reflect commercial practice;
- Acquisition guides that provide guidelines for management and manufacturing process type information requested of the contractor during the solicitation process;
- Interface standards that describe essential interface characteristics;
- Data specifications that describe data products to be delivered;
- Test method standards that describe testing procedures to ensure uniform, comparable results;
- Manufacturing process standards that state the desired outcome of a manufacturing process;
- Standard practices that describe procedures for services, functions, or operation not related to a manufacturing process; and
- Handbooks that provide reference information, acceptable practices, terminology, etc.[3]

Table B-1 summarizes the actions taken to date as a result of the SWAT team's MILSPEC review of approximately 45 MILSPECs.

Defense has also recognized the need to disseminate information to the DoD engineering and acquisition communities and has held seminars to address MILSPEC reform. The 1995 SHAG (Standards Handbooks and Acquisition Guides) Conference presented the process of MILSPEC reform through replacement, reclassification, and cancellation of MILSPECs. MILSPEC reform has been addressed in training conferences on how to develop performance-based specifications. Additional communication vehicles include the Defense Standardization Office home page on the Internet's World Wide Web and industry conferences held by the American National Standards Institute and the American Defense Preparedness Association.[3]

Military Service Implementation

While the SWAT team completes its assessment of all MILSPECs, DoD continues to procure systems. To address the transition between the old way of doing business and the new, each Service has established a standardization reform group. These groups have the responsibility to respond to the PAT's report and to establish ground rules for using MILSPECs in procurements.

Table B-1.
Summary of OSD MILSPEC Actions

Action or recommendation	Number of MILSPECs	Examples pertaining to ICs or microelectronics
Cancel without replacement	11	None
Cancel and replace with the identified commercial document	5	Military Standard (MIL-STD)-275, *Printed Wiring . . .*
Cancel when (or retain until) a suitable commercial document is published	6	MIL-STD-883D, *Test Methods . . .*
Cancel and replace with the identified government document	4	None
Convert to military performance specification	4	MIL-I-38535B, *Integrated Circuits . . .*; and MIL-P-55110, *Printed Wiring Board, Rigid*
Convert to acquisition guide	2	None
Convert to standard practice	1	None
Convert to interface standard	1	None
Replace with handbook	2	MIL-STD-454N, *General Requirements . . .*; and MIL-STD-1547, *Electronic Parts . . . for Space . . .*
Decision deferred	4	None
Other (e.g., superseded)	5	None

Source: Defense Standardization Office home page on the World Wide Web, at http://www.acq.osd.mil/es/std.

Each Service has adopted a slightly different approach to MILSPEC reform. The most restrictive is the Army; the least, the Air Force. This opinion is based on the number of Service-wide exemptions established and each Service's response to the PAT report. The term "exemption" refers to documents that have received Service-wide waivers and may be referenced in RFPs without a program-specific waiver. The policies on implementation of MILSPEC reform for the Army, Navy, and Air Force are summarized in the following paragraphs. While official policy has been issued Service-wide, application at lower levels within each Service may be more stringent than the Service policy. We discuss that application in the subsequent subsection on program office impact.

THE ARMY'S POLICY

The Army was the first to publish formal guidelines for standardization reform, the *Army Implementation Plan*, dated 23 November 1994. The Army policy is to prohibit the use of MILSPECs in all acquisition programs — including all acquisition categories, rebuys, procurements of services, replenishments, and spares — unless authorized by a waiver granted at the appropriate level as identified by the *Army Implementation Plan*. Although the Army has not exempted any MILSPECs, it has exempted 14 technical specifications it developed.

THE NAVY'S POLICY

The Navy does not yet have a document that formally addresses implementation of MILSPEC reform. However, it does have a policy to address this issue. If a program is a reprocurement with minimal or no change, the MILSPECs required in the original procurement may be invoked without a waiver. The goal in any new procurement, or in reprocurements with significant change from the original procurement, is not to require *any* MILSPECs. If a program is a new procurement, a MILSPEC may be placed in the RFP only if it has an exemption or waiver. As of 20 May 1995, the Navy has four exempted standards:

- MIL-STD-461, *Requirements for the Control of Electromagnetic Interference Emissions Characteristics*
- MIL-STD-462, *Measurement of Electromagnetic Interference Characteristics*
- MIL-STD-498, *Software Development and Documentation*
- MIL-STD-1388, *DoD Requirements for a Logistics Support Analysis Record.*

Other MILSPECs require a case-by-case waiver.

THE AIR FORCE'S POLICY

The Air Force has an official policy document on the implementation of acquisition reform that was under review at the time this report was being written. In general, the policy for use of MILSPECs in procurements is that waivers must be obtained unless the document has received an Air Force exemption. The Air Force has exempted 36 MILSPECs as of 20 May 1995. Of the Navy-exempted standards listed above, the Air Force has exempted the first three. It is interesting to note that, while the Navy exempted MIL-STD-1388, the Air Force expressly denied this standard an exemption.

Program Office Impact

When the Perry memorandum was first released in June 1994, no guidelines for implementing its provisions existed. Although the Perry memorandum provided a six-month transition period, DoD directed the removal of all references to MILSPECs in RFPs for many acquisitions that were approaching final RFP release. The first formal guidelines were generated by the Army, but these were not available until November 1994. During this five-month period, many different approaches were taken to satisfy the requirement of using MILSPECs only as a last resort in RFPs.

The Services used inappropriate measures of effectiveness (of the reform initiative) during this period and continue to use some of these measures. The most offensive was comparing the number of MILSPECs referenced in an RFP

before "the new way of doing business" with the number after the RFP was revised. Programs with no MILSPECs were touted as successful simply on the basis of a count. Requests for waivers were initially disallowed. Eventually, the need for a waiver process was recognized, but requesting a waiver was considered a failure in implementing the reform. Fortunately, this attitude is changing and the waiver process is now considered a necessary part of buying reliable military systems. The Navy and the Air Force have granted Service-wide exemptions to specific MILSPECs and allow these exempted documents to be referenced as requirements without a waiver in acquisitions.

We sampled several systems development programs to determine the impact of the Perry memorandum on RFP development. These programs all responded to MILSPEC reform by changing performance specifications and statements of work (SOWs). Table B-2 identifies these programs (without naming them) and indicates their approach to MILSPEC reform.

Table B-2.
Program Office Approach to MILSPEC Reform

System	Service	Type	Approach
System 1	Army	Tactical weapon	All MILSPECs for guidance only; no attempt to identify commercial analogs (at direction of OSD and the Service).
System 2	Army	Tactical weapon	All MILSPEC parts subject to review just before production (at direction of the Service).
System 3	Joint	Unmanned tactical sensor	Few MILSPECs; system comprises mostly nondevelopmental subsystems.
Systems 4 and 5	Navy	Tactical sensor	No MILSPECs; RFP requires bidder to identify appropriate NGS.
System 6	Navy	Tactical system	No MILSPECs; RFP requires bidder to identify appropriate NGS.
System 7	Army	Modification of tactical system	No MILSPECs; NGS acceptable.
System 8	Navy	Training system	Almost all MILSPECs replaced by performance specifications, excerpts from MILSPECs, or commercial standards; or by deleting requirement.

We observed three approaches used by the Services to deal with removal of MILSPECs from the system performance specifications and SOWs. The first involved was to require the contractor to propose alternatives to the established MILSPEC, which abdicated all responsibility to the potential contractor. The second approach was more analytical — researching the standard or specification being eliminated to extract an exact requirement, to identify appropriate industry standards, or to identify the offending standard or specification as

unnecessary. The third approach taken was to justify as many waivers as possible to retain the MILSPEC in the RFP. Clearly, a good program would invoke all three approaches depending on the requirement or MILSPEC under review.

TOWARD MORE EFFECTIVE MILSPEC REFORM

We recommend changes in three areas to improve MILSPEC reform in practice. These areas – phasing in reform, determining and specifying product requirements, and forming tailoring teams – will help DoD buy products at lower prices and from a broader range of companies and at the same time will help preserve military-unique requirements where they are necessary. While our recommendations have been derived from our experience studying ICs, they may be applied generally.

Phasing in Reform

In implementing MILSPEC reform, DoD has taken the position that pilot programs do not work. The reform's directives have been invoked immediately on all programs, regardless of mission or acquisition phase. Unfortunately, all aspects of the reform plan were not in place before it was invoked and many questions remained. For example, a key element of the implementation plan was training, but many program office personnel still have not been trained in the goals or practical approaches to the reform.

Certain elements of the reform can be conducted immediately and concurrently with each other. For example, evaluating MILSPECs for prescriptive language and revising them to be performance or interface standards can and is being done now. Other elements of the reform should not be implemented until certain foundations are in place. Principally, the reform should not be implemented for man-critical systems or for those late in the acquisition cycle until the approach to performance specifications and commercial standards is well understood. We recommend that DoD review its anticipated contract action schedules and prioritize MILSPEC reform according to the guideline shown in Figure B-1.[2] Until the fundamental tasks of MILSPEC review and program office training are complete, DoD should selectively apply the MILSPEC reform mandates to programs where the risk of omitting a performance- or safety-critical MILSPEC is low.

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[2]In contrast, the first programs to be affected by MILSPEC reform were complex Army systems in the late stages of design.

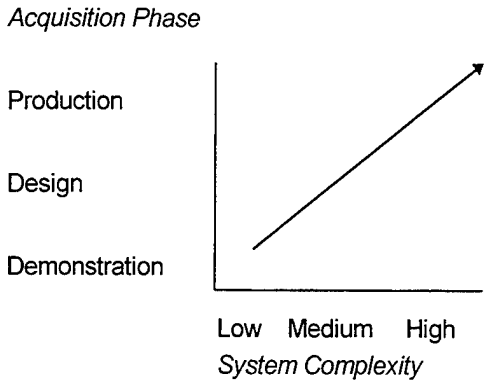

Figure B-1.
Phasing in MILSPEC Reform According to Weapon System Attributes

Determining and Specifying Product Requirements

Effective MILSPEC reform is much more than eliminating MILSPECs from RFPs and contracts. The government must continue to specify its requirements to a degree that ensures that the resulting product will perform its mission with acceptable quality and reliability and yet encourages the adoption of available commercial technologies. Each requirement that would previously have referenced a MILSPEC should now be evaluated, and one of the following alternatives selected:

- Write a pure performance specification.
- Reference an equivalent commercial standard.
- Excerpt from the MILSPEC (tailoring it as appropriate).
- Delete the requirement.

Simply deleting all MILSPECs or making them "for guidance only" leaves not only the system design but its performance, quality, and reliability up to the contractor. This may be appropriate in some acquisitions, but in general, the government will not know what it is buying under those circumstances.

Program offices must implement MILSPEC reform by evaluating the alternatives listed above rather than by simply deleting MILSPECs without review. Such evaluation will require additional time, and perhaps technical talent, not currently available to most programs. DoD certainly does not budget program offices for the additional cost of technical consultants. Those costs must be budgeted for in the future. We cannot afford to have program managers taking shortcuts on MILSPEC reform because of the cost of determining requirements. That cost is an investment necessary to reap the full benefits of MILSPEC reform

That cost is an investment necessary to reap the full benefits of MILSPEC reform and is insurance against acquiring products that fail to meet performance, quality, or reliability expectations.

Forming Tailoring Teams

We recommend that DoD form tailoring teams that expand on the work already done for ICs and that by the SWAT team. The teams should address both the disposition of individual MILSPECs as well as the application of MILSPECs in contracts. The tailoring teams should review all specifications, standards, handbooks, instructions, and commercial alternatives in specific product or functional areas, such as ICs, cost, program management, configuration control, quality assurance, reliability, and logistics support. The teams should recommend changes and provide guidelines for use of commercial alternatives on the basis of costs and benefits.

Other tailoring teams should be formed and assigned to program offices to help generate requirements, prepare RFPs, evaluate bids, and monitor contract technical performance. After a review of the system technology and program mission, these teams would generate a set of requirements tailored to the program and conforming to the spirit and letter of the policy. These activities are done today on a limited basis by "matrix support" engineers. For example, engineers from the U.S. Army Missile Command are supporting the Theater High Altitude Area Defense (THAAD) system program office. The current level of support, however, falls far short of that required for a thorough analysis of applicable MILSPECs.

The tailoring teams could either be newly established or could be existing functional groups, such as the Joint Technical Coordinating Groups. The teams should be supported by departmental standardization resources, should be assembled from the Service engineering and management staffs, and should directly support program office staffs. The existing MILSPEC review structure can continue to provide analysis guidelines, identify functional priorities, set schedules, and review results to ensure that the recommendations preserve essential government benefits.

Although establishing the tailoring teams might at first glance seem expensive, this expense is far below the comparative costs of the massive MILSPEC-reform efforts currently underway in agencies and program offices throughout DoD. These efforts are not only independent and uncoordinated, but are also funded locally and so do not show up as a central cost. The only way to maintain that the local efforts are not true costs is to contend that the employees have no other productive use for their time. A coordinated, functional analysis performed by responsible experts would surely be both better and ultimately cheaper than the current approach.

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[3] Defense Standardization Office home page on the World Wide Web, at http://www.acq.osd.mil/es/std.

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APPENDIX C

Case Studies of Commercial Automotive and Aviation Integrated Circuit Use

PROCUREMENT AND QUALITY MANAGEMENT OF INTEGRATED CIRCUITS BY THE U.S. AUTOMOTIVE INDUSTRY[1]

Background

The major U.S. automobile manufacturers have established a joint technical forum known as the Chrysler Delco Ford Automotive Electronics Council (CDF AEC). The CDF AEC has held several workshops for its members and component suppliers to address the reliability of electronic parts. LMI attended the CDF AEC Automotive Electronics Workshop in Detroit from 19 through 21 October 1994. The workshop was attended by engineers and managers involved in the reliability, qualification, and failure analysis of integrated circuits (ICs).

The U.S. automotive industry is a significant consumer of ICs. The combined demand of the three major manufacturers is approximately 6 million chips per day, which represents about 5 percent of the U.S. total. This is a relatively large demand from a single industry, especially considering the small number of different ICs (on the order of several hundred).[2] The ICs are used for critical engine and safety control systems and for passenger comfort and entertainment systems.

Because of their relatively large annual IC purchases, the automotive manufacturers can influence IC suppliers. Evidence of that influence was the attendance and participation by suppliers at the October workshops. While an attendance list was not provided, we estimate that at least 50 of the attendees were from the IC industry. Further anecdotal evidence is provided by the inclusion of "automotive class" ICs in the catalogs of major IC manufacturers, such as Motorola and Intel.

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[1]The authors wish to thank Mr. Dick Brantley of Delco for providing the information for this section.

[2]Contrast this to DoD, where dollar demand for ICs is of the same magnitude as the automotive industry, but where tens of thousands of part numbers are used.

Automotive ICs are used in a range of environments. The most benign applications are inside the passenger compartment. The most challenging environment is the engine compartment. ICs used "under the hood," such as in engine controllers, are subject to temperature extremes, vibration, shock, and high humidity. Furthermore, some of those applications represent safety-related functions. Automotive operating environments are defined by the Society of Automotive Engineers.

The CDF AEC has identified three "automotive grades," using temperature ranges for its IC applications. The lower bound is -40°C. The upper bounds are 85°C, 105°C, and 125°C.[1]

Approximately 98 percent of the ICs used by the automotive manufacturers are plastic-encapsulated microcircuits (PEMs). The remainder are field-programmable devices with quartz windows. All of their ICs are considered standard products by the suppliers. Since the automotive applications are not functionally demanding, the jobs can be done readily by standard products.

The automotive manufacturers favor the use of established technologies where the behavior is known (especially of failure mechanisms), and manufacturing processes are understood and in control. That bias is partially evidenced by the fact that typical production yields are above 90 percent. The automotive manufacturers believe that new technologies require some time for reliability to mature. For example, the failure rate of surface-mount-technology ICs decreased by an order of magnitude from 1990 to 1994. On the other hand, they are interested in reducing the cost, and some new technologies eventually become more reliable than their predecessors.

CDF AEC Quality Standards A100 and Q100

The CDF AEC has developed a two-part approach to ensuring the quality of its ICs: development and implementation of quality systems (known as process qualification) and product testing (i.e., device environmental qualification). The semiconductor industry is adopting the CDF AEC's customer standards.

Process Qualification

Process qualification is used by the AEC members to determine whether an IC supplier has incorporated the essential ingredients of a quality system. An advance copy of the CDF AEC standard, CDF-AEC-A100, *Quality System Assessment for Semiconductor Suppliers* (19 October 1994), is available to current and potential suppliers.

That document describes assessment of the supplier's design methodology, design validation, process capability and controls, environmental test facilities, failure analysis and corrective action, and customer satisfaction. It contains 157 questions that are scored on the basis of conformance and implementation.

Twenty-two of the questions are satisfied if International Organization for Standardization ISO 9000 certification exists; the remainder (according to AEC members) cover additional breadth and depth. The major assessment topics in A100 are as follows:

- Management responsibility
- Specification review
- Document and data control
- Control of customer-supplied products
- Process control
- Inspection, measuring, and test equipment
- Control of nonconforming products
- Handling, storage, packaging, and delivery
- Internal quality audits
- Statistical techniques
- Continuous improvement
- Quality system
- Design control
- Subcontractor and subsupplier control
- Product identification and traceability
- Inspection and testing
- Inspection and test status
- Corrective and preventive action
- Control of quality records
- Training
- Production part approval process
- Manufacturing capabilities.

Supplier review begins with a self-audit using the questions in the A100 guide. The results are submitted to an automotive-industry audit team, which then performs an on-site assessment. Review teams usually contain three to five people. Reviews may last from several days to a full week. The supplier is scored according to criteria in the A100 document. Generally, satisfaction of the criteria for one automobile manufacturer is considered sufficient by the others. Audits by third parties have been discussed but not approved.

In addition to the A100 process, the CDF AEC members use supplier-resident engineers to work with selected IC suppliers. Resident engineers review test programs, product failures, and quality-system improvement. The emphasis is on helping prevent failures rather than on dealing with failures after the fact. Even when the failure rates are quite low, the automotive manufacturers expressed intent to continue using resident engineers. Their experience shows that failure rates can increase to their old levels if discipline and attention are not maintained. Delco has found the use of resident engineers to be important for reducing IC failure rates.

PRODUCT TESTING

Product testing is the second major part of the automobile industry's approach to quality management for IC procurement. The CDF AEC has issued a specification, CDF-AEC-Q100, *Stress Test Qualification for Automobile-Grade Integrated Circuits* (9 June 1994). Q100 is the automotive industry's version of MIL-STD-883D, *Test Methods and Procedures for Microelectronics*. Q100 defines the stress test requirements and test conditions for qualifying ICs for the automotive environment.

The Q100 specification describes test samples, the definition of failure, criteria for qualifying a device, and the use of generic data. The requirements for qualifying a new device are given in two tables. Those tables list 27 stress tests, including electrical, temperature, shock, vibration, humidity, bond strength, and early life failure rate. For each test, the tables show the sample per lot size, the number of lots, the acceptance threshold, references, and any additional requirements. The document also addresses the tests that are necessary to requalify a device that has been modified. Discussions at the October workshop indicate Q100 will be reviewed based on failure experience and technology evolution.

Procurement Practice for Integrated Circuits

APPROVED PARTS LIST

Each automotive company maintains an approved parts list (or catalog). The company's engineers are expected to try to use parts from the approved parts list. For custom and semicustom parts, performance specifications are set by the system electrical design engineer.

QUALITY PROBLEM RESOLUTION

IC suppliers are expected to analyze failures and to respond to any part deficiency. Most suppliers also have on-site field application engineers who diagnose and verify part deficiencies in situ and typically are involved in the corrective actions. Suppliers are expected to analyze the root cause for all deficiencies attributable to their parts.

If a problem is found on the assembly line or as a result of a line pull, the failed part is sent back to the supplier for failure analysis and corrective action, to be completed within 30 days. The supplier bears the costs. Warranty failures of safety-related equipment (e.g., engine control, brakes, airbag) are returned to Delco for analysis and, where appropriate, remanufacturing (Ford and Chrysler do not remanufacture). Warranty failures of nonsafety equipment (e.g., audio, heating and air conditioning) receive less scrutiny. The automotive company bears the costs of the failure. In the event of a gross problem, the automotive

company may pursue damages from the supplier. Only one such case occurred in the last three years.

Reliability Data on Integrated Circuits

Automotive ICs currently fail at a rate of about 10 to 20 failures per million parts after 50,000 miles. Automotive electrical engineers believe that design problems are a bigger cause of field failures than fabrication problems.

The automotive companies collect field data on IC failures. Delco collects that data by part number and routinely analyzes the data to identify trends. Because of higher reliability, the defect data base is becoming sparser and more emphasis is being placed on understanding the physical causes of failures. The automotive companies expect that, by the end of the decade, IC reliability will be so high that statistical reliability testing may become prohibitively expensive as the sole method for demonstrating reliability (but will remain a necessary tool). More testing will be done at the wafer level. Current specifications do not require wafer-level testing, but more customers are demanding such tests during fabrication.

Long-Term Availability of Parts

The automotive development cycle is two to three years. Suppliers are involved at least two years before the start of production. They are contracted for an estimated annual usage for the duration of the program. For an engine control module, that period could be five or six years. Suppliers are expected to provide spare parts for service for five years beyond the end of production.

Procurement and Quality Management of Integrated Circuits at the Boeing Aircraft Company[3]

Background

LMI visited the Boeing Defense and Space Group (BD&SG) and Boeing's Commercial Aircraft Group in Kent, Washington, on 3 and 4 November 1994. BD&SG is responsible for the procurement and quality management of ICs for both defense and commercial IC applications at Boeing.

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[3]The authors wish to thank Mr. Jim O'Brien of Boeing for providing the information for this section.

Boeing is a low-volume buyer of ICs, with total annual procurements of around 50,000 units. These ICs are typically used in applications such as cabin environmental control and entertainment systems. While much larger volumes of ICs are used within Boeing aircraft in applications such as navigation, radar, communication, and other avionics, these are not generally purchased directly by Boeing but rather are specified, procured, and controlled by the subtier vendors who provide such subsystems. In addition, these vendors or equipment are generally selected by the customer (Military Service or airline) rather than by Boeing.

Because Boeing is such a low-volume buyer, it has little or no leverage with the IC producers. The company therefore has developed a unique buying strategy for ICs that minimizes its procurement burden, outsourcing much of its quality management function, and minimizes its supplier base interface: it buys all its ICs through a small number of third-party IC testing laboratories.

The ICs that are purchased by Boeing are generally operated in fairly benign environments, such as an aircraft cabin's temperature, humidity, and vibration. A few ICs are subject to extremely harsh conditions, and these are subjected to more rigorous requirements and controls than the typical procurement.

Ninety-five percent of all ICs purchased by Boeing are PEMs. Most ICs are selected directly from off-the-shelf catalogs. Some custom-designed hybrids are used. Boeing uses a small number of hermetically packaged chips in applications that experience high temperatures. The company purchases a few application-specific integrated circuits (ASICs).

Boeing D1-9000 Quality Standard

Boeing's D1-9000 quality standard, defined in Handbook D1-9000, *Advanced Quality System for Boeing Suppliers,* applies to all Boeing procurement activities. It covers three major topics:

- Basic quality system
- Advanced quality system (AQS)
- Supplier quality rating.

The section of the standard covering basic quality systems describes basic requirements that must be in place to qualify as a Boeing supplier. The section covering advanced quality systems describes advanced quality tools, methodology, and documentation that are required to build parts that meet D1-9000 requirements. These include key characteristics, statistical control, capability, and sources of variation. The AQS tools section provides a tutorial on the various tools identified as requirements in the previous section. The supplier quality rating section describes how Boeing evaluates suppliers' compliance with the requirements of D1-9000 and how quality performance is measured.

BASIC QUALITY SYSTEM

The requirements of the basic quality system are similar to ISO 9000 requirements. They cover the system design and management of the following:

- Procedures
- Records
- Manufacturing quality control
- Training
- Drawings
- Digital media
- Specifications
- Proprietary designs
- Procurement by the supplier
- Inspection stamps
- Measurement and test equipment
- Tooling
- Inspection methods
- Functional tests
- Shipping
- Quality audit program
- Authority and responsibility.

Manufacturing quality controls include inventory controls, production and process controls, and discrepancy controls designed to ensure compliance with drawings, specifications, and standards throughout all stages of design and production. This ensures that all IC producers on Boeing's qualified supplier list have adequate and capable manufacturing and quality management processes.

In having suppliers procure products and services, Boeing assigns responsibility to the supplier for the quality of all materials, articles, software, and services purchased from subtier suppliers and ensures flow down of AQS requirements to the subtier suppliers. This places responsibility for IC quality squarely on the shoulders of the test laboratories that supply ICs to Boeing.

ADVANCED QUALITY SYSTEM

AQS requirements address determining key characteristics that must be controlled to ensure quality, providing evidence of variation, identifying and controlling the sources of variation, flowing down key characteristics to subtier suppliers, and establishing a continuous quality improvement process. A major goal of AQS is the compilation of process knowledge that can be used to conduct quality planning in advance of production. Use of this knowledge will allow manufacturers to build parts correctly the first time.

AQS includes analytical techniques — such as brainstorming, Pareto analysis, and risk analysis — that help teams operate successfully. Other techniques include using flow charts, control charts, and cause-and-effect diagrams; gage

variation studies; and designed experiments. Qualified suppliers are expected to understand and use these techniques.

Supplier Quality Rating

The purpose of the supplier quality rating is to identify suppliers producing superior quality products and to focus suppliers' attention on areas requiring improvement. The assessment is based on quality potential and actual quality performance. A 100-point scoring system is used to represent supplier quality. The supplier's quality potential is determined during an on-site review by a Boeing quality team. The Boeing quality team audits vendor operations, looking for the same basic factors as Defense Electronic Supply Center Qualified Manufacturers List Program audits. The team asks specific questions pertaining to the supplier's basic and advanced quality system, and planning and production control system. The quality-potential rating is predictive and is used as a leading indicator of quality performance. The audit generally takes two days with a team of two or three people. A large audit might require five or six team members.

Quality performance is determined on the basis of product rejections and the company's responsiveness to requests for corrective actions. Measurement also focuses on the reduction in product variation as indicated by capability ratios. Total quality rating scores are compiled by commodity type. Rating reports are provided to Boeing buyers and are a significant element in procurement decisions. Quality ratings are distributed to suppliers monthly by Boeing.

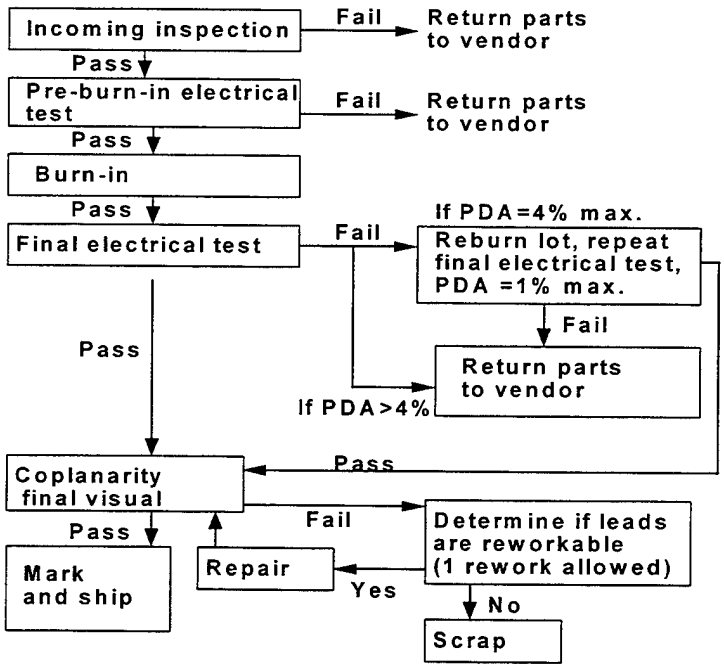
Qualification Tests for Integrated Circuits

Boeing's IC specifications frequently are based on existing military specifications — such as MIL-STD-883D, *Test Methods and Procedures for Microelectronics,* for burn-in and solderability. However, Joint Electron Device Engineering Council (JEDEC) specifications form the backbone of Boeing's specifications, particularly for packaging. With global competition increasing in the aircraft industry, Boeing is also tracking the European standards, which contain different application-based quality levels. Qualification testing consists of the test sequence shown in Table C-1.

Table C-1.
Boeing's Qualification Test Sequence

Category	Test method
1. Screening	100 percent, as specified by Boeing
2. Life test	Per MIL-STD-883D, method 1005, test temperature specified by Boeing, 5 pieces
3. Highly accelerated stress test	Per JEDEC Standard 22, method A-110, test condition C, 100 hours duration, DC bias, 5 pieces
4. Temperature cycling	Per MIL-STD-883D, method 1010, –65°C to +150°C, 1,000 cycles, 5 pieces
5. Thermal shock	Per MIL-STD-883D, method 1011, –65°C to +150°C, 300 cycles, 5 pieces
6. Solderability	Per MIL-STD-883D, method 2003, 3 pieces, 0 failures
7. Resistance to solvents	Per MIL-STD-883D, method 2015, 4 pieces, 0 failures

Part screening is illustrated in Figure C-1. The order of temperature tests may be changed at the discretion of the test laboratory.



Note: PDA = Percent Defects Allowable

Figure C-1.
Part Screening Required by Boeing

Procurement Practice for Integrated Circuits

Qualified Vendor List

Boeing maintains a list of qualified vendors for each IC. A Boeing quality team visits potential vendors (two or three new vendors per year) and, using Boeing's Handbook D1-9000, *Advanced Quality System for Boeing Suppliers*, assesses their capabilities. The D1-9000 approach is somewhat of a cross between an ISO 9000 audit and the Malcolm Baldrige assessment developed by the Department of Commerce. Vendors who are found by the Boeing quality team to satisfy the D1-9000 requirements are placed on the qualified vendors list. Once on the list, they are not systematically reexamined until and unless the performance of their products is unsatisfactory.

Boeing places purchase orders for ICs with several commercial test laboratories. Boeing's purchase orders specify the type of IC to be procured and the tests to be performed, typically a three-temperature test and burn-in of 168 hours on 100 percent of the parts. The laboratories generally select the IC vendors, purchase the ICs, conduct the tests, and supply the parts to Boeing. After testing, the laboratory assigns a Boeing part number to the item. In rare instances (about 55 part numbers), the IC testing is conducted by the manufacturer rather than the third-party test laboratory. Purchased ASICs are screened and tested by the manufacturer.

Boeing generally seeks price quotes for a given buy from two or three of the six test laboratories it currently uses. Boeing will generally buy from the lowest-bidding test laboratory. Test laboratories must purchase ICs only from vendors that are listed on Boeing's qualified vendor list. Within that constraint the laboratories are free to negotiate their own best price with the manufacturer.

Quality Problem Resolution

If significant problems with ICs do arise, Boeing works directly with the vendors (both manufacturers and third-party test laboratories) to review the test specifications and find solutions. Boeing deals with problems of "poor quality" case by case.

IC Reliability Data

Boeing does not collect much reliability data on its ICs. The firm does not require failed parts to be returned for analysis and gets little data on part failures in Boeing-supplied military systems. For commercial aircraft, Boeing gets somewhat better feedback during the aircraft's warranty period (generally three years), but after that period it gets no feedback. During that initial three-year period, IC failures are extremely rare.

Incoming Quality

Ninety-five percent of the 50,000 ICs that Boeing purchases annually for commercial use are PEMs, which have had excellent incoming quality. Test laboratories conduct a three-temperature test and a 168-hour burn-in with a fall-out rate of about 0.2 percent from such testing. The extremely low failure rate and incidence of manufacturing defects permits Boeing to ignore requirements for warranties on ICs. Just processing or returning the few failures would cost Boeing more than replacing failed parts with new parts. Boeing's close relationships and arrangements with their third-party testing houses generally ensures that failed parts would be quickly replaced, with no questions asked, if any significant quantities were involved.

Boeing does not additionally test ICs purchased from the test laboratories before their assembly into avionics systems. The first testing within Boeing of these parts is during system-level testing.

Other Issues and Trends

Long-Term Availability of Parts

Because Boeing's aircraft tend to remain in airline inventories for a long time (over 20 years), the company is concerned about continuing parts availability and diminishing manufacturing sources, as is DoD. It attempts to address this problem through two approaches. First, Boeing conducts an annual survey of IC vendors to seek out and identify potential problem ICs. Vendors generally notify Boeing whenever an IC it uses is going to be discontinued. Boeing then has the option to make a lifetime buy of the item before it is discontinued. However, the company has no formal contractual arrangements with vendors to ensure future availability of parts. In general, military suppliers are better at providing notification of pending obsolescence than are commercial vendors. Boeing's second approach is to routinely upgrade and improve their systems and design out old and obsolescent parts whenever possible. The company does this through complete board or system redesigns, increasingly using ASICs.

Internal Design Capability for Application-Specific Integrated Circuits

Boeing has developed an internal ASIC design capability. While this capability is currently quite small, it is developing a track record for excellence. The company sees its use of ASICs increasing in the future, particularly in new aircraft designs and in quality improvements for existing aircraft.

Boeing does not see its IC requirements as unique or different from similar industries and would welcome a broader approach to standardization and quality acceptance. Boeing Commercial Avionics Systems is prepared to join with, pool, and accept IC or vendor data from other industries such as the automobile industry.

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APPENDIX D

Contract Clauses

Table D-1 lists the contract clauses remaining after implementation of the Federal Acquisition Streamlining Act of 1994 (FASA) that present the most significant barriers to commercial firms doing business with DoD. The clauses are grouped by the subject categories used in the text of Chapter 3. Following the tables, each clause is presented on a one-page form that addresses it in more detail. This latter presentation is organized by clause number to enable the reader to locate a specific clause of interest more easily.

Table D-1.
Clauses Remaining as Barriers After FASA Implementation

FAR/DFARS reference	Clause title
Cost or Pricing Data	
52.214-26	Audit — Sealed Bidding
52.214-28	Subcontractor Cost or Pricing Data — Modifications — Sealed Bidding
52.215-1	Examination of Records by Comptroller General
52.215-2	Audit — Negotiation
52.215-24	Subcontractor Cost or Pricing Data
52.215-25	Subcontractor Cost or Pricing Data — Modifications
52.216-5	Price Redetermination — Prospective
52.216-6	Price Redetermination — Retroactive
52.244-2	Subcontracts (Cost-Reimbursement and Letter Contracts)
Cost Collection and Reporting	
252.234-7000	Notice of Cost/Schedule Control Systems
252.234-7001	Cost/Schedule Control Systems
Source Restrictions	
252.225-7000	Buy American Act — Balance of Payments Program Certificate
252.225-7001	Buy American Act and Balance of Payments Program
252.225-7006	Buy American Act — Trade Agreements Act — Balance of Payments Program Certificate
252.225-7007	Trade Agreements Act
52.225-1	Buy American Certificate

Note: FAR = Federal Acquisition Regulation; DFAR = Defense Federal Acquisition Regulation Supplement.

Table D-1.
Clauses Remaining as Barriers After FASA Implementation (Continued)

FAR/DFARS reference	Clause title
52.225-20	Buy American Act — North American Free Trade Agreement Implementation Act — Balance of Payments Program
52.225-21	Buy American Act — North American Free Trade Agreement Implementation Act — Balance of Payments Program
Data Rights	
252.227-7013	Rights in Technical Data — Noncommercial Items
252.227-7017	Identification and Assertion of Use, Release, or Discount Restrictions
252.227-7026	Deferred Delivery of Technical Data or Computer Software
252.227-7027	Deferred Ordering of Technical Data or Computer Software
252.227-7037	Validation of Restrictive Markings on Technical Data
Socioeconomic Requirements	
Small Business/Small Disadvantaged Business Subcontracting	
252.219-7003	Small Business and Small Disadvantaged Business Subcontracting Plan (DoD Contracts)
52.219-9	Small Business and Small Disadvantaged Business Subcontracting Plan
Disabled Veterans, Vietnam-Era Veterans, and Handicapped Workers	
52.222-35	Affirmative Action for Special Disabled and Vietnam Era Veterans
52.222-36	Affirmative Action for Handicapped Workers
52.222-37	Employment Reports on Special Disabled Veterans and Veterans of the Vietnam Era
General Affirmative Action and Equal Opportunity	
52.222-21	Certification of Nonsegregated Facilities
52.222-26	Equal Opportunity
Precious and Specialty Metals	
252.208-7000	Intent to Furnish Precious Metals as Government- Furnished Material
252.225-7014	Preference for Domestic Specialty Metals [including Alternate I]

Note: FAR = Federal Acquisition Regulation; DFAR = Defense Federal Acquisition Regulation Supplement.

The information on the following forms is extracted from an LMI computer data base of contract clauses. The data base contains many common acronyms and abbreviations, the more significant of which we list in Table D-2.

Table D-2.
Abbreviations Used in LMI Contract Clause Data Base

Abbreviation	Definition
CFR	Code of Federal Regulations
DFARS	Defense Federal Acquisition Regulation Supplement
DoDD	Department of Defense Directive
DoDI	Department of Defense Instruction
DoL	Department of Labor
EO	Executive Order
FAR	Federal Acquisition Regulation
OFPP	Office of Federal Procurement Policy
OMB	Office of Management and Budget
PL	Public Law
SBA	Small Business Administration
SF	Standard Form
U.S.C	United States Code

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 252.208-7000 **Source:** DODD 4160.22, DODI 4140.41

Title: INTENT TO FURNISH PRECIOUS METALS AS GOVERNMENT-FURNISHED MATERIAL

Description: Govt. intent to furnish precious metals; identifies 7 metals stored in Govt. inventory. Offeror must provide offer with/without Govt. furnished precious metals.

Presciption: 208.7305(a) All solicitations and contracts unless contracting officer determines that precious metals are not available from Govt. stockpile, or items do not require precious metals, or acquisition is below FAR 13.000 threshold.

Flow Down: Mandatory **Flows Down to:** All tiers

Existing Exemption for Clause Application:

☐ **Commercial Items** ☒ **Small Purchases** ☒ **Other (if any):** Contracting officer decision per DFARS 208.7305(a)

Barrier to Commercial Firm:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Major if precious metals furnished; otherwise, minor administrative costs. Requires identification of precious metals and estimated weights, and requires submission of alternate bids, one with Gov't -provided metals, the other with contractor-provided metals. Major administrative record-keeping impact if Gov't furnishes metals.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☒ **Commercial Items** ☐ **Simplified Procurements** ☐ **None** ☒ **Partial:** Contracts under $100,000

Effect of FASA on Clause:

Application threshold raised to $100,000, clause does not flow to commercial components. Application remains part of DoD policy to utilize precious metals stockpile rather than have vendors purchase and charge open market prices.

Extent of Barrier After Application of FASA:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

The decision to furnish a commercial component implies that the precious metal acquisition decison was accomplished when the components were manufactured, making the provision of Gov't precious metals only one of replacing consumed materials. Therefore, we recommend that the requirements not apply in all cases where commercial components are being acquired as part of the prime contract end item.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 252.219-7003 **Source:** 15 USC 637(d)(4), PL 101-189 Sect. 834, PL 103-160 Sec.t. 811

Title: SMALL BUSINESS AND SMALL DISADVANTAGED BUSINESS SUBCONTRACTING PLAN (DOD CONTRACTS)

Description: Used when FAR 52.219-9 Small Business Subcontracting Plan is used

Presciption: 219.708(b)(1)(A) Solicitations and contracts that contain 52.219-9.

Flow Down: Requirements of clause flow down, but not clause itself **Flows Down to:** First tier only

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Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☒ **Other (if any):** Not applicable under $500,000 ($1 million construction)

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Administration. Prime must set up plan for basic contract and options, submit SF 294/295 subcontracting report, identify small businesses and keep records on methods used, outreach methods, records of internal guidance to buyers, and cooperate with SBA studies. Failure to comply is material breach of contract, possible liquidated damages.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☒ **Commercial Items** ☐ **Simplified Procurements** ☐ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA does not address this clause. FASA implementation regulations state that an annual, commercial company-wide, division-wide, or plant-wide subcontracting plan will suffice for commercial item contracts and subcontracts.

Extent of Barrier After Application of FASA:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Apply for exemption from this requirement when procuring commercial items or dealing with firms that are primarily commercial in market orientation

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 252.225-7000 **Source:** EO 10582 as amended, (PL 428, 41 USC 10a), Presidential Directive Nov 16, 1960, PL 100-418, OMB Circular A-20 revised

Title: BUY AMERICAN ACT - BALANCE OF PAYMENTS PROGRAM CERTIFICATE

Description: Contractor must certify origin of end product to be delivered to the Govt.

Presciption: 225.109(a) Solicitations for supplies where Buy American clause (252.225-7001) is used instead of 52.225-1, unless 252.225-7007 is used. There are numerous exceptions to the requirement; see 225.102.

Flow Down: Requirements of clause flow down, but not clause itself **Flows Down to:** All tiers

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Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☒ **Other (if any):** Various conditions

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Major administrative impact, in that prime and subs must identify origin of every non-domestic product, certifying origin of end product and components, although certificate applies to end product. Manufacturer may or may not be able to distinctly identify country of origin for each component. Certificate states that if component is of unknown origin, cost has to be computed as foreign sourced. The impact on the prime, other than the certification itself, is that the prime must know where components come from to determine if the end item can be determined as of American origin (e.g., over 50 percent of the cost of goods). This provision would require a tracking/marking system not required for commercial customers.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☒ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA does not address the Buy American Act.

Extent of Barrier After Application of FASA:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Seek legislation that would exempt this requirement for acquisitions of commercial products and commercial components.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 252.225-7001 **Source:** EO 10582 as amended, (PL 428, 41 USC 10a), Presidential Directive Nov 16, 1960, PL 100-418, OMB Circular A-20 revised

Title: BUY AMERICAN ACT AND BALANCE OF PAYMENTS PROGRAM

Description: Definitions and certification of domestic or qualifying country end product. If not, 50% evaluation factor added.

Presciption: 225.109(d) Use instead of FAR 52.225-3 and 52.225-7 in solicitations and contracts that require furnishing of supplies. There are numerous complex exemptions, and the DFARS evaluation procedure is different from FAR. 225.102-108.

Flow Down: Requirements of clause flow down, but not clause itself **Flows Down to:** All tiers

---

Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☒ **Other (if any):** Various reasons (not commercial product)

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Significant cost and administrative impact. Prime must know the source of all components, and determine if components manufactured in the US exceed 50 percent of the cost of all components. Clause applies to end items rather than components, so it would not apply to a product unless the product was the contracted end item.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☒ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA does not address the Buy American Act.

Extent of Barrier After Application of FASA:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Seek legislation that would exempt commercial components and ICs from application of Buy American Act provisions.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 252.225-7006 **Source:** PL 428, 41 USC 10, EO 10582, Presidential Directive Nov 16, 1960, PL 96-39, 19 USC 2501-2582, OMB Circular A-20 revised

Title: BUY AMERICAN ACT - TRADE AGREEMENTS ACT - BALANCE OF PAYMENTS PROGRAM CERTIFICATE

Description: Defines domestic and designated country end products. Contractor must identify country of origin and provide certificates for all non-domestic end products.

Presciption: 225.407(a)(1) Use in lieu of FAR 52.225-8 whenever the clause 252.225-7007 is used.

Flow Down: Requirements of clause flow down, but not clause itself **Flows Down to:** All tiers

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Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☐ **Other (if any):**

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Requires extensive record keeping, contractor must identify country of origin for supplies and the subs may need to identify country of origin for supplies in order for the prime to meet reporting requirements.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☒ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA does not address the Buy American Act.

Extent of Barrier After Application of FASA:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Seek legislation that would exempt commercial components and ICs from application of Buy American Act provisions.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 252.225-7007 **Source:** EO 12260, 19 USC 2501-2582

Title: TRADE AGREEMENTS ACT

Description: Provides preference for U.S., Designated Countries, and Caribbean Basin countries. Includes definitions and certification requirements.

Presciption: 225.407(a)(2) For all solicitations and contracts subject to the Trade Agreements Act. Use instead of 52.225-9.

Flow Down: Requirements of clause flow down, but not clause itself **Flows Down to:** All tiers

---

Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☒ **Other (if any):** Various (not commercial)

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Contractor must keep track of sources, as items may be components subjected to Trade Agreements Act provisions.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☒ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA does not address the Trade Agreements Act.

Extent of Barrier After Application of FASA:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Seek legislation that would exempt commercial components and ICs from application of Trade Agreements Act provisions.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 252.225-7014 **Source:** PL 92-570 and subsequent appropriations acts, PL 103-139 Sec. 8005 made permanent at 10 USC 2241 note

Title: PREFERENCE FOR DOMESTIC SPECIALTY METALS

Description: Specialty metals must be melted in the U.S., its possessions, or Puerto Rico.

Presciption: 225.7002-4(c) All solicitations and contracts over the threshold in FAR 13 that require delivery of an article containing specialty metals. Use with Alt. I for major programs.

Flow Down: Requirements of clause flow down, but not clause itself **Flows Down to:** All tiers

---

Existing Exemption for Clause Application:

☐ **Commercial Items** ☒ **Small Purchases** ☒ **Other (if any):** Various (not commercial)

Barrier to Commercial Firm:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Major if metals furnished. Applies to all solicitations where specialty metals may be furnished as part of end item defined as: aircraft; missile and space systems; ships; tank-automative; weapons; or ammunition.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☒ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA does not exempt clause.

Extent of Barrier After Application of FASA:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

The requirements of this clause may flow down for commercial ICs and components. We recommend reviewing the flowdown application for commercial components and applying for a legislative change to provide an exemption for commercial components.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 252.225-7014 **Source:** PL 92-570 and subsequent appropriations acts

Title: PREFERENCE FOR DOMESTIC SPECIALTY METALS - ALTERNATE I

Description: Specialty metals must be melted in the U.S., its possessions, or Puerto Rico. Alt. I requires flow down.

Presciption: 225.7002-4(c) All solicitations and contracts over the FAR Part 13 threshold that require delivery of an article containing specialty metals for major programs: aircraft, missile and space systems, ships, tank-automotive, weapons or ammunition.

Flow Down: Mandatory **Flows Down to:** All tiers

Existing Exemption for Clause Application:

☐ **Commercial Items** ☒ **Small Purchases** ☒ **Other (if any):** Various (not commercial)

Barrier to Commercial Firm:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Major if specialty metals furnished. Applies to all solicitations where specialty metals may be furnished as part of end item defined as: aircraft; missile and space systems; ships; tank-automative; weapons; or ammunition.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☒ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA does not exempt clause.

Extent of Barrier After Application of FASA:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

The requirements of this clause may flow down for commercial ICs and components. We recommend reviewing the flowdown application for commercial components and applying for a legislative change to provide an exemption for commercial components.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 252.225-7035 **Source:** PL 103-182

Title: BUY AMERICAN ACT -- NORTH AMERICAN FREE TRADE AGREEMENT IMPLEMENTATION ACT -- BALANCE OF PAYMENTS PROGRAM CERTIFICATE

Description: Offeror must certify the country of origin of end items. An evaluation preference is given to U.S., Qualifying Country, or NAFTA country end products.

Presciption: 225.408(a)(3) Use in lieu of FAR clause 52.225-20, when the acquisition is not subject to the Trade Agreements Act but is subject to NAFTA.

Flow Down: Requirements of clause flow down, but not clause itself **Flows Down to:** All tiers

---

Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☐ **Other (if any):**

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Not a commercial practice. Certificate applies to end product. Manufacturer may or may not be able to identify the country of origin for each component. Certificate states that if component is of unknown origin, cost has to be computed as foreign sourced. The impact on the prime, other than the certification itself, is that the prime must know where components come from to determine if the end item can be determined as of American origin (e.g., over 50 percent of the cost of goods). This provision would require a tracking/marking system not required for commercial customers.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☒ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA does not address the Buy American Act.

Extent of Barrier After Application of FASA:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Seek legislation that would exempt this requirement for acquisitions of commercial products and commercial components.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 252.225-7036 **Source:** PL 103-182

Title: NORTH AMERICAN FREE TRADE AGREEMENT IMPLEMENTATION ACT

Description: Implements NAFTA. Contractor must deliver U.S. products unless it certified otherwise in clause 252.225-7035.

Presciption: 225.408(a)(4) Use in lieu of FAR clause 52.225-21, when the acquisition is not subject to the Trade Agreements Act but is subject to NAFTA, and the estimated value is $50,000 or more.

Flow Down: Requirements of clause flow down, but not clause itself **Flows Down to:** All tiers

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Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☐ **Other (if any):**

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Not a commercial practice. Certificate applies to end product. Manufacturer may or may not be able to identify the country of origin for each component. Certificate states that if component is of unknown origin, cost has to be computed as foreign sourced. The impact on the prime, other than the certification itself, is that the prime must know where components come from to determine if the end item can be determined as of American origin (e.g., over 50 percent of the cost of goods). This provision would require a tracking/marking system not required for commercial customers.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☒ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA does not address NAFTA.

Extent of Barrier After Application of FASA:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Seek legislation that would exempt this requirement for acquisitions of commercial products and commercial components.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 252.225-7036 **Source:** PL 103-182

Title: NORTH AMERICAN FREE TRADE AGREEMENT IMPLEMENTATION ACT - ALTERNATE I

Description: Implements NAFTA. Contractor must deliver U.S. or Canadian products unless it certified otherwise in clause 252.225-7035.

Presciption: 225.408(a)(4)(B)(ii) Use in lieu of FAR clause 52.225-21, when the acquisition is not subject to the Trade Agreements Act but is subject to NAFTA, and the estimated value is between $25,000 and $50,000.

Flow Down: Requirements of clause flow down, but not clause itself **Flows Down to:** All tiers

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Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☐ **Other (if any):**

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Not a commercial practice. Certificate applies to end product. Manufacturer may or may not be able to identify the country of origin for each component. Certificate states that if component is of unknown origin, cost has to be computed as foreign sourced. The impact on the prime, other than the certification itself, is that the prime must know where components come from to determine if the end item can be determined as of American origin (e.g., over 50 percent of the cost of goods). This provision would require a tracking/marking system not required for commercial customers.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☒ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA does not address NAFTA.

Extent of Barrier After Application of FASA:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Seek legislation that would exempt this requirement for acquisitions of commercial products and commercial components.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 252.227-7013 **Source:** 10 USC 2320, EO 12591

Title: RIGHTS IN TECHNICAL DATA -- NONCOMMERCIAL ITEMS

Description: Govt. obtains Unlimited, Govt. Purpose, or Limited rights to technical data based upon how the technical data was funded. Establishes marking requirements.

Presciption: 227.7103-6(a) Use when technical data will be required to be delivered to the Government. See exceptions listed under 227.7103-6(a).

Flow Down: Mandatory **Flows Down to:** All tiers

Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☒ **Other (if any):** Commercial items if they are the only deliverable

Barrier to Commercial Firm:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

The prime contractor must identify origin of its own technical data and must identify and protect subcontractors technical data. However, this clause provides limited rights to the Govt. for the prime and subs' commercial technical data for contracts where technical data is to be delivered The clause prohibits passage to any third party without contractor approval.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☒ **Commercial Items** ☐ **Simplified Procurements** ☐ **None** ☐ **Partial:**

Effect of FASA on Clause:

No exemption provided in FASA for rights in technical data for either the prime or subs under contracts for non-commercial items.

Extent of Barrier After Application of FASA:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Recent revisions to the technical data rights policy have eased the subcontractor burden somewhat when the only deliverable is a commercial item, however, the data rights policy is still complex and therefore remains a potential barrier to all firms, especially when requirements may be flowed down to subcontractors.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 252.227-7013 **Source:** 10 USC 2320, EO 12591

Title: RIGHTS IN TECHNICAL DATA -- NONCOMMERCIAL ITEMS -- ALTERNATE I

Description: Same as basic clause but Govt. reliquishes its right to publish the data in favor of public dissemination by the contractor.

Presciption: 227.7103-6(b) Used in research contracts where Govt. is willing to relinquish its right to publish data/software for sale.

Flow Down: Mandatory **Flows Down to:** All tiers

Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☒ **Other (if any):** Commercial items if they are the only deliverable

Barrier to Commercial Firm:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

The prime contractor must identify origin of its own technical data and must identify and protect subcontractors technical data. However, this clause provides limited rights to the Govt. for the prime and subs' commercial technical data for contracts where technical data is to be delivered The clause prohibits passage to any third party without contractor approval.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☒ **Commercial Items** ☐ **Simplified Procurements** ☐ **None** ☐ **Partial:**

Effect of FASA on Clause:

No exemption provided in FASA for rights in technical data for either the prime or subs under contracts for non-commercial items.

Extent of Barrier After Application of FASA:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Recent revisions to the technical data rights policy have eased the subcontractor burden somewhat when the only deliverable is a commercial item, however, the data rights policy is still complex and therefore remains a potential barrier to all firms, especially when requirements may be flowed down to subcontractors.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 252.227-7015 **Source:** 10 USC 2320, EO 12591

Title: TECHNICAL DATA -- COMMERCIAL ITEMS

Description: Govt. obtains only technical data customarily provided to the public, and must negotiate for additional rights.

Presciption: 227.7102-3 Use in all solicitations and contracts when the contractor will be required to deliver technical data pertaining to commercial items, components, or processes.

Flow Down: Requirements of clause flow down, but not clause itself **Flows Down to:** All tiers

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Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☐ **Other (if any):**

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

This clause provides limited rights to the Govt. for the prime and subs' commercial technical data for contracts where technical data is to be delivered. The clause prohibits passage to any third party without contractor approval.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☒ **None** ☐ **Partial:**

Effect of FASA on Clause:

No exemption provided in FASA for limited rights in technical data for either the prime or subs under contracts for commercial items.

Extent of Barrier After Application of FASA:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

The data rights policy remains a potential barrier to all firms.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 252.227-7017 **Source:** 10 USC 2320

Title: IDENTIFICATION AND ASSERTION OF USE, RELEASE, OR DISCLOSURE RESTRICTIONS

Description: Requires contractor to assert, at time offer is submitted to the Government, the restrictions on use of the contractor's and subcontractor's technical data/software.

Presciption: 227.7103-3(b), 7104, 7203-3 Use in solicitations containing 252.227-7013; SBIR solicitations and contracts containing 252.227-7018; and in all solicitations that contain 252.227-7014.

Flow Down: Requirements of clause flow down, but not clause itself **Flows Down to:** All tiers

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Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☒ **Other (if any):** Commercial items if they are the only deliverable

Barrier to Commercial Firm:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Requires the contractor to identify the technical data that will be furnished with restrictions on Government use. Contractor must maintain records to validate the restrictions.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☒ **Commercial Items** ☐ **Simplified Procurements** ☐ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA Section 8106 establishes a presumption that technical data under prime and subcontracts for commercial items are developed at private expense.

Extent of Barrier After Application of FASA:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

This provision would not be used when only commercial items are to be delivered, but its requirements may be flowed down in subcontracts if both commercial and noncommercial items are being supplied.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 252.227-7026 **Source:** 10 USC 2320(b)(2)

Title: DEFERRED DELIVERY OF TECHNICAL DATA OR COMPUTER SOFTWARE

Description: Prime and subs may be required to deliver tech data to Govt. up to two years after end item delivery or after contract termination.

Presciption: 227.405-71(b) Used when the contract requires delivery of technical data or computer software, but does not contain a specified delivery time.

Flow Down: Requirements of clause flow down, but not clause itself **Flows Down to:** All tiers

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Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☐ **Other (if any):**

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Prime and subcontractor have to be able to provide technical data or computer software to the Gov't if ordered up to two (2) years after all deliveries under the contract were accomplished, or up to two years after the contract was terminated.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☒ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA does not address deferred delivery of technical data.

Extent of Barrier After Application of FASA:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

The clause can be revised to exclude the subcontractor from the delivery requirement, or to have the prime serve as the storage depository in case the Gov't exercises its delivery authority. However, the scope of potential requirements for all technical data or computer software required under the contract may make implementation of changes in this area very difficult.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 252.227-7027 **Source:** 10 USC 2320(b)(2)

Title: DEFERRED ORDERING OF TECHNICAL DATA OR COMPUTER SOFTWARE

Description: Prime and sub must deliver tech data to Govt. if ordered up to 3 years after all deliveries completed, or after contract termination .

Presciption: 227.405-71(c) Used when potential need exists for technical data or computer software, but a firm requirment is not established.

Flow Down: Requirements of clause flow down, but not clause itself **Flows Down to:** All tiers

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Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☐ **Other (if any):**

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Prime and subcontractor have to be able to provide technical data or computer software to the Gov't if ordered up to three years after all deliveries under the contract were accomplished, or up to three years after the contract was terminated.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☒ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA does not address deferred ordering of technical data or computer software.

Extent of Barrier After Application of FASA:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

The clause can be revised to exclude the subcontractor from the delivery requirement, or to have the prime serve as the storage depository in case the Gov't exercises its delivery authority. However, the scope of potential requirements for all technical data or computer software required under the contract may make implementation of changes in this area very difficult.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 252.227-7037 **Source:** 10 USC 2321, 10 USC 2320(b)(1)

Title: VALIDATION OF RESTRICTIVE MARKINGS ON TECHNICAL DATA

Description: Primes and subs must justify restrictive markings.

Presciption: 227.7102-3(c), 7103, 4, 720 Use in solicitations and contracts that require the delivery of technical data. There are multiple prescriptions that apply based on the circumstance.

Flow Down: Mandatory **Flows Down to:** All tiers

Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☒ **Other (if any):** See prescriptions for various exceptions.

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

The clause creates a complex record-keeping requirement that does not exist for commercial buyers. Under the clause, primes and subs must justify restrictive markings, which may be challenged by the Contracting Officer.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☒ **Commercial Items** ☐ **Simplified Procurements** ☐ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA Section 8106 establishes a presumption that technical data under prime and subcontracts for commercial items are developed at private expense. FASA implementation regulations make 10 USC 2321, Validation of Proprietary Data, inapplicable to contracts and subcontracts for commercial items.

Extent of Barrier After Application of FASA:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Recent changes in technical data policy ease the contractor's burden for commercial items, as DoD is not to challenge a contractor's assertion that the item was developed at private expense unless it can demonstrate otherwise. The contractor may still need to keep records in order to respond to any such challenges.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 252.234-7000 **Source:** OMB Circular A-109, DODI 7000.2

Title: NOTICE OF COST/SCHEDULE CONTROL SYSTEMS

Description: Requires primes and subs to submit cost/scheduling plan.

Presciption: 234.005-70 When C/SCSC compliance is required.

Flow Down: Requirements of clause flow down, but not clause itself **Flows Down to:** All tiers

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Existing Exemption for Clause Application:

☐ **Commercial Items** ☒ **Small Purchases** ☐ **Other (if any):**

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

The clause requires primes and subs to submit a complex plan to provide cost and schedule data that includes planning, budgeting, and scheduling procedures. The C/SCSC process , including Gov't procedures to validate both prime and subs procedures, is a Gov't designed system not based on commercial practices.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☒ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA does not adress the issue of C/SCSC compliance.

Extent of Barrier After Application of FASA:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

The primary method of removing this extensive barrier would be to provide for an exemption from C/SCSC requirements for commercial products or commercial components going into a non-commercial gov't product.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 252.234-7001 **Source:** 10 USC 2432, OMB Circular A-109, DODI 7000.2

Title: COST/SCHEDULE CONTROL SYSTEMS

Description: Requires primes and subs to submit a cost/schedule plan for selected major systems

Presciption: 234.005-70 When compliance with C/SCSC is required for selected major systems acquisitions.

Flow Down: Requirements of clause flow down, but not clause itself **Flows Down to:** All tiers

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Existing Exemption for Clause Application:

☐ **Commercial Items** ☒ **Small Purchases** ☒ **Other (if any):** Only applies to selected major systems

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

The clause, applied for selected major systems acquisitions, requires primes and subs to submit a complex plan to provide cost and schedule data that includes planning, budgeting, and scheduling procedures. The C/SCSC process , including Gov't procedures to validate both prime and subs procedures, is a Gov't designed system not based on commercial practices.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☒ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA does not adress the issue of C/SCSC compliance.

Extent of Barrier After Application of FASA:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

The primary method of removing this extensive barrier would be to provide for an exemption from C/SCSC requirements for commercial products or commercial components going into a non-commercial Gov't product.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 52.214-26 **Source:** 10 USC 2306(f)(5), 10 USC 2306(f)(1)(B)&(D), 10 USC 2306a(f)

Title: AUDIT AND RECORDS - SEALED BIDDING

Description: Comptroller General can audit if contractor submits certified cost/pricing data

Presciption: 14.201-7(a) Insert in IFBs and contracts expected to exceed $100,000.

Flow Down: Mandatory **Flows Down to:** All tiers

Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☐ **Other (if any):**

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Broad audit rights of Government discourage firms from competing for government contracts.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☒ **Commercial Items** ☐ **Simplified Procurements** ☐ **None** ☐ **Partial:**

Effect of FASA on Clause:

Prohibits contracting officers from requesting cost & pricing data on competitive commercial contracts. States that contractors should not keep different records than those kept in ordinary course of business. Applies to subcontracts. Although certified cost or pricing data may not be required, the Government may audit all information provided for two years after the award date. The audit is limited to determining whether the information was accurate.

Extent of Barrier After Application of FASA:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Seek legislative change to exempt commercial item prime and subcontracts from audit.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 52.214-28 **Source:** 10 USC 2306a(a) & (b)

Title: SUBCONTRACTOR COST OR PRICING DATA - MODIFICATIONS - SEALED BIDDING

Description: Comptroller General can audit if contractor submits certified cost/pricing data

Presciption: 14.201-7(c) Insert in IFBs and contracts expected to exceed $500,000.

Flow Down: Mandatory **Flows Down to:** All tiers

Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☐ **Other (if any):**

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Inability of commercial subs to comply with Government requirements for cost or pricing data

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Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☒ **Commercial Items** ☐ **Simplified Procurements** ☐ **None** ☐ **Partial:**

Effect of FASA on Clause:

Contracting officers may request cost or pricing data in certain situations, or other cost data in most situations to establish price reasonableness. The Government still has the right to audit the information provided for two years.

Extent of Barrier After Application of FASA:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Seek legislation to exempt commercial items from requirement to submit cost or pricing data, and/or petition the Administrator of OFPP to add this law to the list of laws inapplicable to commercial items pursuant to FASA Section 8003.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 52.215-1 **Source:** 10 USC 2313(b)

Title: EXAMINATION OF RECORDS BY COMPTROLLER GENERAL

Description: Comptroller General can audit records for 3 years, including 1st tier subs

Presciption: 15.106-2(b) When contracting by negotiation, insert in solicitations and contracts except small purchases under FAR Part 13.

Flow Down: Mandatory **Flows Down to:** First tier only

Existing Exemption for Clause Application:

☐ **Commercial Items** ☒ **Small Purchases** ☒ **Other (if any):** Not utilities; foreign; applies to negotiated contracts

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Prime must include clause in 1st tier subcontracts. Broad Govt. audit rights discourage firms from competing.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☐ **None** ☒ **Partial:** Audit right reduced from 3 to 2 years in certain circumstances.

Effect of FASA on Clause:

Changed audit right from 3 years to 2 years for information provided to Government in lieu of cost or pricing data on commercial items. FASA partially removed barrier, but Gov't audit rights retained for 1st tier subs providing non-commercial items. If an IC manufacturer, as a first tier subcontractor, is offering a commercial IC, the item is exempt from cost or pricing data, but Government right to audit information provided to determine price reasonableness still remains.

Extent of Barrier After Application of FASA:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Seek legislation to exempt commercial item contracts and subcontracts from audit, and/or petition the Administrator of OFPP to add this law to the list of laws inapplicable to commercial items pursuant to FASA Section 8003.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 52.215-2 **Source:** 10 USC 2313(a), 10 USC 2306a(f), OMB Circular A-133

Title: AUDIT - NEGOTIATION

Description: Comptroller General can audit if contractor submits certified cost/pricing data

Presciption: 15.106-2(b) When contracting by negotation insert in solicitations and contracts unless the acquisition is a small purchase under Part 13.

Flow Down: Mandatory **Flows Down to:** All tiers

Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☐ **Other (if any):**

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Broad Gov't audit rights discourage firms from competing.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☐ **None** ☒ **Partial:** Changed audit rights from 3 to 2 years in certain circumstances

Effect of FASA on Clause:

Changed audit right from 3 years to 2 years for information provided to the Government in lieu of cost or pricing data on commercial items. The Government retains authority to determine accuracy and completeness of information provided, and has ability to examine contractor and subcontractor records. Clause applies whether or not cost or pricing data are submitted.

Extent of Barrier After Application of FASA:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Seek legislation to remove audit requirement from commercial item contracts and subcontracts, and/or petition the Administrator of OFPP to add this law to the list of laws inapplicable to commercial items pursuant to FASA Section 8003.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 52.215-24 **Source:** 10 USC 2306a, See also 41 USC 254

Title: SUBCONTRACTOR COST OR PRICING DATA

Description: Subcontractors must submit certified cost/pricing data for contract modifications

Presciption: 15.804-8(c) Used in all procurements when adequate price competition, etc., is not present for subcontracts expected to exceed $500,000.

Flow Down: Mandatory **Flows Down to:** All tiers

Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☐ **Other (if any):**

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Subs must submit certified cost or pricing data which is not a standard commercial practice. Commercial firms do not provide customers such a detailed look at pricing methodologies.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☒ **Commercial Items** ☐ **Simplified Procurements** ☐ **None** ☐ **Partial:**

Effect of FASA on Clause:

Contracting officers may request cost or pricing data in certain situations, or other cost data in most situations to establish price reasonableness. The Government still has the right to audit the information provided for two years.

Extent of Barrier After Application of FASA:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Seek legislation to exempt commercial items from requirement to submit cost or pricing data, and/or petition the Administrator of OFPP to add this law to the list of laws inapplicable to commercial items pursuant to FASA Section 8003.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 52.215-25 **Source:** 10 USC 2306a, See also 41 USC 254

Title: SUBCONTRACTOR COST OR PRICING DATA - MODIFICATIONS

Description: Subcontractors must submit certified cost/pricing data for contract modifications.

Presciption: 15.804-8(d) Used in all procurements when adequate price competition, etc., was not present for subcontracts expected to exceed $500,000, and modifications will exceed $500,000.

Flow Down: Mandatory **Flows Down to:** All tiers

Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☐ **Other (if any):**

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Subs must submit certified cost or pricing data which is not a standard commercial practice. Commercial firms do not provide customers such a detailed look at pricing methodologies.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☒ **Commercial Items** ☐ **Simplified Procurements** ☐ **None** ☐ **Partial:**

Effect of FASA on Clause:

Contracting officers may request cost or pricing data in certain situations, or other cost data in most situations to establish price reasonableness. The Government still has the right to audit the information provided for two years.

Extent of Barrier After Application of FASA:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Seek legislation to exempt commercial items from requirement to submit cost or pricing data, and/or petition the Administrator of OFPP to add this law to the list of laws inapplicable to commercial items pursuant to FASA Section 8003.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 52.215-43 **Source:** 10 USC 2306a(d)(3), 41 USC 254b(d)(2) & (3)

Title: AUDIT -- COMMERCIAL ITEMS

Description: Gives Government the right to audit data submitted to establish price reasonableness for two years after date of contract award.

Presciption: 15.106-2 Negotiated solicitations and contracts when submission of cost or pricing data is expected to be excepted, and solicitations and contracts when cost or pricing data is required but may be excepted for subcontracts.

Flow Down: Requirements of clause flow down, but not clause itself **Flows Down to:** All tiers

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Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☐ **Other (if any):**

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

This type of audit is not a commercial practice and can have a chilling effect on commercial firms' willingness to provide components to be used in DoD end items.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☒ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA created this requirement.

Extent of Barrier After Application of FASA:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Seek legislative relief to repeal this requirement.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 52.216-5 **Source:**

Title: PRICE REDETERMINATION - PROSPECTIVE

Description: Allows for periodic price redetermination within contract ceiling

Presciption: 16.205-4 Insert when contracting by negotation when a fixed price contract is contemplated and the conditions specified in 16.205-2 and 16.205-3(a) thru (d) apply.

Flow Down: Parts of clause flow down **Flows Down to:** All tiers

---

Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☐ **Other (if any):**

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☐ **Major** ☒ **Uncertain**

Based on provisions not part of standard commercial practice, e.g., subsequent price reduction. Complex process that allows for periodic price redetermination within contract ceiling price, which may result in reduction in contract price, although it protects the contractor from price increases, e.g., fluctuations in precious metal prices.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☒ **Commercial Items** ☐ **Simplified Procurements** ☐ **None** ☐ **Partial:**

Effect of FASA on Clause:

Clause no longer flows to subcontractors providing commercial components.

Extent of Barrier After Application of FASA:

☐ **None** ☐ **Minor** ☐ **Major** ☒ **Uncertain**

Recommendation for Addressing Barrier:

Use fixed-price incentive contracts in acquisitions where it is not possible to negotiate fair and reasonable fixed-prices beyond the initial period of contract performance.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 52.216-6 **Source:**

Title: PRICE REDETERMINATION - RETROACTIVE

Description: Allows for retroactive price redetermination within contract ceiling

Presciption: 16.206-4 Insert when contracting by negotiation when a fixed price contract for R&D under $100,000 is contemplated and the conditions in 16.206-2 and 16.206-3(a) thru (d) apply.

Flow Down: Parts of clause flow down **Flows Down to:** All tiers

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Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☐ **Other (if any):**

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☐ **Major** ☒ **Uncertain**

Based on provisions not part of standard commercial practice, e.g., price reduction that goes back to initial contract deliveries. Complex process that allows for periodic price redetermination within contract ceiling price, which may result in reduction in contract price, although it protects the contractor from price increases, e.g., fluctuations in precious metal prices.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☒ **Commercial Items** ☐ **Simplified Procurements** ☐ **None** ☐ **Partial:**

Effect of FASA on Clause:

Clause no longer flows to subcontractors providing commercial components.

Extent of Barrier After Application of FASA:

☐ **None** ☐ **Minor** ☐ **Major** ☒ **Uncertain**

Recommendation for Addressing Barrier:

Use fixed-price contracts.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 52.219-9 **Source:** 15 USC 637(d)(5) and (6), PL 100-656

Title: SMALL BUSINESS AND SMALL DISADVANTAGED BUSINESS SUBCONTRACTING PLAN

Description: Defines and describes requirements for subcontracting plans

Presciption: 19.708(b) Use in negotiated solicitations and resulting contracts expected to exceed $500,000 ($1 million for construction of any public facility) and are required to include 52.219-8.

Flow Down: Requirements of clause flow down, but not clause itself **Flows Down to:** First tier only

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Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☒ **Other (if any):** Not applicable under $500,000 ($1 million construction) or small business set asid

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Administration. Prime must set up plan for basic contract and options, submit SF 294/295 subcontracting report. Identify small businesses and keep records on methods used, outreach methods, records of internal guidance to buyers, and cooperate with SBA studies. Failure to comply is material breach of contract, possible liquidated damages.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☒ **Commercial Items** ☐ **Simplified Procurements** ☐ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA does not address this clause. FASA implementation proposed regulations state that an annual, commercial company-wide, division-wide, or plant-wide subcontracting plan will sufice for commercial item contracts and subcontracts.

Extent of Barrier After Application of FASA:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Not a standard commercial practice. Very cumbersome for contractor to comply. Commercial practice is to establish long-term relationships with vendors regardless of business size. Apply to Congress for legislation that would exempt this requirement for acquisitions of commercial products and commercial components.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 52.219-9 **Source:** 15 USC 637(d)(4) and (6)

Title: SMALL BUSINESS AND SMALL DISADVANTAGED BUSINESS SUBCONTRACTING PLAN - ALTERNATE I

Description: Defines and describes requirements for subcontracting plans

Presciption: 19.708(b) Use when contracting by sealed bidding. Substitute Par. (c) for Par. (c) in basic clause; other conditions the same.

Flow Down: Requirements of clause flow down, but not clause itself **Flows Down to:** First tier only

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Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☒ **Other (if any):** Not applicable under $500,000 ($1 million construction)

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Administration. Prime must set up plan for basic contract and options, submit SF 294/295 subcontracting report. Identify small businesses and keep records on methods used, outreach methods, records of internal guidance to buyers, and cooperate with SBA studies. Failure to comply is material breach of contract, possible liquidated damages.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☒ **Commercial Items** ☐ **Simplified Procurements** ☐ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA does not address this clause. FASA implementation proposed regulations state that an annual, commercial company-wide, division-wide, or plant-wide subcontracting plan will suffice for commercial item contracts and subcontracts.

Extent of Barrier After Application of FASA:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Not a standard commercial practice. Very cumbersome for contractor to comply. Commercial practice is to establish long-term relationships with vendors regardless of business size. Apply to Congress for legislation that would exempt this requirement for acquisitions of commercial products and commercial components.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 52.222-21 **Source:** EO 11246, 41 CFR 60-1.8

Title: CERTIFICATION OF NONSEGREGATED FACILITIES

Description: Contractor agrees not to segregate facilities

Presciption: 22.810(a)(1) Solicitations over $10,000 containing the Equal Opportunity clause (52.222-26).

Flow Down: Mandatory **Flows Down to:** All tiers

Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☒ **Other (if any):** Applies over $10,000 and with EEO clause (52.222-26)

Barrier to Commercial Firm:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Administration and risk of debarment

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☒ **Commercial Items** ☐ **Simplified Procurements** ☐ **None** ☐ **Partial:**

Effect of FASA on Clause:

Certification no longer flows down to subcontractors providing commercial items.

Extent of Barrier After Application of FASA:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Replace need for certificate with a contract notice reminding that compliance is required.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 52.222-26 **Source:** EO 11246, 41 CFR 60-1.4(a), 42 USC 2000e

Title: EQUAL OPPORTUNITY

Description: Basic EEO clause -- post notices, etc.

Presciption: 22.810(e) All solicitations and contracts unless fully exempt from the requirements of EO 11246.

Flow Down: Parts of clause flow down **Flows Down to:** All tiers

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Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☒ **Other (if any):** Applies if agency regulation and value more than $10,000

Barrier to Commercial Firm:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Administrative -- post notices, etc. -- may be no more than law.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☒ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA did not address this subject.

Extent of Barrier After Application of FASA:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Replace clause with a contractual notice reminding that compliance is required, and/or petition the Administrator of OFPP to add this law to the list of laws inapplicable to commercial items pursuant to FASA Section 8003.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 52.222-26 **Source:** EO 11246, 41 CFR 60-1.4(a), 42 USC 2000e

Title: EQUAL OPPORTUNITY - ALTERNATE I

Description: Use if some but not all terms of basic EEO clause exempt.

Presciption: 22.810(e) Use in solicitations and contracts if any of the clause terms are exempt from the requirements of EO 11246.

Flow Down: Parts of clause flow down **Flows Down to:** All tiers

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Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☒ **Other (if any):** Applies if aggrgate more than $10,000 and EEO exemptions

Barrier to Commercial Firm:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Administrative -- reviewing exemptions

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☒ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA did not address this subject

Extent of Barrier After Application of FASA:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Replace clause with a contractual notice reminding that compliance is required, and/or petition the Administrator of OFPP to add this law to the list of laws inapplicable to commercial items pursuant to FASA Section 8003.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 52.222-35 **Source:** 41 CFR 60-250.4, EO 11701, 38 USC 4100ff

Title: AFFIRMATIVE ACTION FOR SPECIAL DISABLED AND VIETNAM ERA VETERANS

Description: Must list openings and post signs

Presciption: 22.1308(a)(1) Solicitations and contracts for $10,000 or more, with certain exceptions (outside U.S. or Agency Head has waived).

Flow Down: Mandatory **Flows Down to:** All tiers

Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☒ **Other (if any):** Applies if over $10,000

Barrier to Commercial Firm:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Fair amount of administration and sign posting

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☒ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA did not address this subject.

Extent of Barrier After Application of FASA:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Seek exemption from the requirement if acquiring a commercial item or dealing with a primarily commercial firm, and/or petition the Administrator of OFPP to add this law to the list of laws inapplicable to commercial items pursuant to FASA Section 8003.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 52.222-35 **Source:** 41 CFR 60-250.4, EO 11701, 38 USC 4100ff

Title: AFFIRMATIVE ACTION FOR SPECIAL DISABLED AND VIETNAM ERA VETERANS-ALTERNATE I

Description: Lists terms of basic clause that have been waived

Presciption: 22.1308(a)(2) When the agency head waives one or more of the terms of the basic clause.

Flow Down: Mandatory **Flows Down to:** All tiers

Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☒ **Other (if any):** Applies if more than $10,000 and basic clause has part waived

Barrier to Commercial Firm:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Administrative review of waivers

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☒ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA did not address this subject.

Extent of Barrier After Application of FASA:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Seek exemption from the requirement if acquiring a commercial item or dealing with a primarily commercial firm, and/or petition the Administrator of OFPP to add this law to the list of laws inapplicable to commercial items pursuant to FASA Section 8003.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 52.222-36 **Source:** 41 CFR 60-741.4, 29 USC 793, EO 11758

Title: AFFIRMATIVE ACTION FOR HANDICAPPED WORKERS

Description: Contractor can't discriminate; comply with rules, post signs

Presciption: 22.1408 Solicitations and contracts over $25,000, with certain exceptions (outside U.S. or Agency Head has waived).

Flow Down: Mandatory **Flows Down to:** All tiers

Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☒ **Other (if any):** Applies if over $10,000

Barrier to Commercial Firm:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Administrative -- posting signs, etc.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☒ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA did not address this subject.

Extent of Barrier After Application of FASA:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Seek exemption from the requirement when buying a commercial item or dealing with a primarily commercial firm, and/or petition the Administrator of OFPP to add this law to the list of laws inapplicable to commercial items pursuant to FASA Section 8003.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 52.222-36 **Source:** 41 CFR 60-741.4, 29 USC 793, EO 11758

Title: AFFIRMATIVE ACTION FOR HANDICAPPED WORKERS-ALTERNATE I

Description: Lists terms of basic clause that have been waived

Presciption: 22.1408 When the agency head waives one or more of the terms of the basic clause.

Flow Down: Mandatory **Flows Down to:** All tiers

Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☒ **Other (if any):** Applies if over $10,000

Barrier to Commercial Firm:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Administrative to review parts of clause waived

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☐ **Commercial Items** ☐ **Simplified Procurements** ☒ **None** ☐ **Partial:**

Effect of FASA on Clause:

FASA did not address this subject.

Extent of Barrier After Application of FASA:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Seek exemption from the requirement when buying a commercial item or dealing with a primarily commercial firm, and/or petition the Administrator of OFPP to add this law to the list of laws inapplicable to commercial items pursuant to FASA Section 8003.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 52.222-37 **Source:** 38 USC 2012 and DoL implementing regulations

Title: EMPLOYMENT REPORTS ON SPECIAL DISABLED VETERANS AND VETERANS OF THE VIETNAM ERA

Description: Requires contractor to submit annual reports

Presciption: 22.1308(b) Solicitations and contracts containing the clause at 52.222-35.

Flow Down: Mandatory **Flows Down to:** All tiers

Existing Exemption for Clause Application:

☐ **Commercial Items** ☐ **Small Purchases** ☒ **Other (if any):** Applies if over $10,000 and with 52.222-35

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Contractor must keep records and file reports.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☒ **Commercial Items** ☐ **Simplified Procurements** ☐ **None** ☐ **Partial:**

Effect of FASA on Clause:

Clause no longer flows down to subcontractors providing commercial components.

Extent of Barrier After Application of FASA:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Seek exemption from requirements for all commercial items.

CONTRACT CLAUSES THAT ARE BARRIERS TO COMMERCIAL IC INSERTION

Clause Number: 52.244-2 **Source:** 10 USC 2306(e), 41 USC 254(b)

Title: SUBCONTRACTS (COST-REIMBURSEMENT AND LETTER CONTRACTS)

Description: Identifies rules for subcontracting, including certified cost/pricing data and CAS disclosure statement.

Presciption: 44.204(b) Use in all cost reimbursement and letter contracts.

Flow Down: Parts of clause flow down **Flows Down to:** All tiers

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Existing Exemption for Clause Application:

☒ **Commercial Items** ☐ **Small Purchases** ☒ **Other (if any):** Exempt for CAS disclosure statement.

Barrier to Commercial Firm:

☐ **None** ☐ **Minor** ☒ **Major** ☐ **Uncertain**

Establishes requirements for certified cost or pricing data and disclosure statements that provide detailed Gov't visibility into subs accounting and pricing practices.

Federal Acquisition Streamlining Act (FASA) Exemption for Clause Application:

☒ **Commercial Items** ☐ **Simplified Procurements** ☐ **None** ☐ **Partial:**

Effect of FASA on Clause:

Government may request information to establish price reasonableness. This information may be audited.

Extent of Barrier After Application of FASA:

☐ **None** ☒ **Minor** ☐ **Major** ☐ **Uncertain**

Recommendation for Addressing Barrier:

Petition OFPP to remove audit requirement for commercial items.

APPENDIX E

Glossary

ACAT	=	Acquisition Category
AEC	=	Automotive Electronics Council
AF	=	Air Force
ANSI	=	American National Standards Institute
AQS	=	Advanced Quality System
ASIC	=	application-specific integrated circuit
BD&SG	=	Boeing Defense and Space Group
C/SCSC	=	cost/schedule control systems criteria
CAS	=	Commercial Avionics Systems
CCII	=	Center for Commercial IC Insertion
CDF	=	Chrysler Delco Ford
CO	=	contracting officer
DESC	=	Defense Electronic Supply Center
DFARS	=	Defense Federal Acquisition Regulation Supplement
DISC	=	Defense Industrial Supply Center
DoD	=	Department of Defense
DoDISS	=	DoD Index of Standards and Specifications
DRAM	=	dynamic, random-access memory
DSB	=	Defense Science Board
EEPROM	=	electronically erasable, programmable, read-only, memory
EPROM	=	erasable, programmable, read-only memory

FAR	=	Federal Acquisition Regulation
FASA	=	Federal Acquisition Streamlining Act of 1994 (Pub.L. 103-355)
IC	=	integrated circuit
IDA	=	Institute for Defense Analyses
IRP	=	Industry Review Panel
ISO	=	International Organization for Standardization
JEDEC	=	Joint Electron Device Engineering Council
MILSPEC	=	military specification
NGS	=	nongovernmental standard
NSN	=	national stock number
OEM	=	original-equipment manufacturer
OFPP	=	Office of Federal Procurement Policy
OSD	=	Office of Secretary of Defense
PAT	=	process action team
PDA	=	percent defects allowable
PEM	=	plastic-encapsulated microcircuit
PPA	=	Plastic Package Availability
QM	=	quality management
QML	=	qualified manufacturers list
QPL	=	qualified parts list
RFP	=	Request for Proposal
SHAG	=	Standards Handbooks and Acquisition Guides
SECDEF	=	Secretary of Defense
SIA	=	Semiconductor Industry Association
SMD	=	standard microcircuit drawing

SOW	=	Statement of Work
SRAM	=	static, random-access memory
SWAT	=	Standards We Attack Tenaciously
THAAD	=	Theater High Altitude Area Defense
TINA	=	Truth in Negotiations Act

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Using more commercial and commercially derived silicon-based integrated circuits in DoD hardware can save the Department money and give it access to better technology. Before the defense industry can use more commercial integrated circuits, however, barriers imposed by the Federal government must be overcome. These barriers fall into two general categories: technical and administrative. Technical barriers include design conservatism due to a lack of data that characterize the commercial devices and the military environments in which those devices would have to perform. Military standards and specifications reform is helping to remove technical barriers, but some military standards should continue to be applied to integrated circuit procurement. The Federal Acquisition Streamlining Act of 1994 has greatly reduced administrative barriers, but impediments remain in government requirements related to cost or pricing data, cost collection and reporting, data rights, source restrictions, socioeconomic goals, and special materials provisions.

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